



A Veteran Owned Small Business

HAL-PE ASSOCIATES
ENGINEERING SERVICES, INC.

Department of Veteran Affairs

Medical Center

2250 Leestown Road

Lexington, KY 40511

Replace Exterior Lighting on Buildings

Project 596-12-101

Engineer of Record

HAL-PE Associates Engineering Services, Inc.

823 Scott Blvd.

Covington, KY 41011



**DEPARTMENT OF VETERANS AFFAIRS
VHA MASTER SPECIFICATIONS**

**TABLE OF CONTENTS
Section 00 01 10**

	DIVISION 00 - SPECIAL SECTIONS	DATE
00 01 15	List of Drawing Sheets	09-11
	DIVISION 01 - GENERAL REQUIREMENTS	
01 00 00	General Requirements	06-11
01 32 16.15	Project Schedules (Small Projects - Design/Bid/Build	04-10
01 33 23	Shop Drawings, Product Data, and Samples	11-08
01 42 19	Reference Standards	09-11
	DIVISION 09 - FINISHES	
09 91 00	Painting	06-12
	DIVISION 26 - ELECTRICAL	
26 05 11	Requirements for Electrical Installations	09-10
26 05 21	Low-Voltage Electrical Power Conductors and Cables (600 Volts and Below)	09-10
26 05 26	Grounding and Bonding for Electrical Systems	09-10
26 05 33	Raceway and Boxes for Electrical Systems	09-10
26 32 13	Engine Generators	09-10
26 36 23	Automatic Transfer Switches	09-10
26 51 00	Interior Lighting	04-09
26 56 00	Exterior Lighting	09-10

Replace Exterior Lighting on Buildings
VAMC LD, Lexington, KY
Project No. 596-12-101

SECTION 00 01 15
LIST OF DRAWING SHEETS

The drawings listed below accompanying this specification form a part of
the contract.

<u>Drawing No.</u>	<u>Title</u>
	GENERAL
GI001	Cover Sheet - General Index, Site Plan
	ELECTRICAL
EL001	Exterior Egress Lighting Bldgs 1,2,3,4
EL002	Exterior Egress Lighting Bldgs 12,17,25
EL003	Exterior Egress Lighting Bldgs 16,27,28,29
EL004	Emergency Power / Exterior Egress Lighting on Bldgs 22,37,39,47
EL005	Photometrics
EL006	Luminaire Schedule
EL007	Panel Schedules and Single-Line Diagram
	PLUMBING
PP001	Generator Gas Piping and Specifications

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Replace Exterior Lighting on Buildings
VAMC LD, Lexington, KY
Project No. 596-12-101

**SECTION 01 00 00
GENERAL REQUIREMENTS**

TABLE OF CONTENTS

1.3 SPECIFICATIONS AND DRAWINGS FOR CONTRACTOR.....	4
1.4 CONSTRUCTION SECURITY REQUIREMENTS.....	4
1.5 FIRE SAFETY.....	9
1.6 OPERATIONS AND STORAGE AREAS.....	14
1.7 ALTERATIONS.....	18
1.8 INFECTION PREVENTION MEASURES.....	19
1.9 DISPOSAL AND RETENTION.....	23
1.10 PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS.....	24
1.11 RESTORATION.....	25
1.12 PHYSICAL DATA.....	25
1.13 not used.....	26
1.14 not used.....	26
1.15 AS-BUILT DRAWINGS.....	26
1.16 USE OF ROADWAYS.....	26
1.17 not used.....	27
1.18 TEMPORARY USE OF MECHANICAL AND ELECTRICAL EQUIPMENT.....	27
1.19 TEMPORARY USE OF EXISTING ELEVATORS.....	28
1.20 NOT USED IN THIS CONTRACT.....	28
1.21 TEMPORARY TOILETS.....	28
1.22 AVAILABILITY AND USE OF UTILITY SERVICES.....	28
1.23 not used.....	29
1.24 TESTS.....	29
1.25 INSTRUCTIONS.....	30

Replace Exterior Lighting on Buildings

VAMC LD, Lexington, KY

Project No. 596-12-101

1.26 not used.....	31
1.27 RELOCATED EQUIPMENT.....	31
1.28 not used.....	32
1.29 not used.....	32
1.30 SAFETY SIGN.....	32
1.31 not used.....	32
1.32 not used.....	32
1.33 HISTORIC PRESERVATION.....	32
1.34 MINIMUM HOURLY RATES OF WAGES.....	32
1.35 QUALITY PLAN.....	32
ATTACHMENT A - PERMIT FOR CUTTING AND WELDING WITH PORTABLE GAS OR ARC EQUIPMENT.....	
ATTACHMENT B - FIRE AND SMOKE BARRIER PERMIT.....	40
ATTACHMENT C - INTERIM LIFE SAFETY MEASURE (ILSM) FORMS.....	
ATTACHMENT D - UTILITY SYSTEMS SERVICE/OUTAGE NOTIFICATION FORM.....	
ATTACHMENT E - INFECTION CONTROL RISK ASSESSMENT FORMS.....	
ATTACHMENT F - AIR PERMIT APPLICATION EXAMPLE.....	

**SECTION 01 00 00
GENERAL REQUIREMENTS**

1.1 GENERAL INTENTION

- A. Contractor shall completely prepare site for building operations, including demolition and removal of existing structures, and furnish labor and materials and perform work for Project 596-12-101 Replace Exterior Lighting on Building, Leestown Division (LD) as required by drawings and specifications. Work shall include replacing the majority of all exterior building mounted light fixtures, and installing new emergency generator with the intent of improving the buildings' safety and security lighting levels.
- B. Visits to the site by Bidders may be made only at the designated Pre-Bid Meeting as listed in the Solicitation.
- C. Offices of HAL-PE Associates Engineering Services, Inc. as the Architect-Engineers will render certain technical services during construction. Such services shall be considered as advisory to the Government and shall not be construed as expressing or implying a contractual act of the Government without affirmations by Contracting Officer or duly authorized representative.
- D. Prepare EPA Air Permit Application:
1. Approved generator submittals are required prior to completing EPA Air Permit application. Submit generator submittals within 21-days after receiving Notice to Proceed from Contracting Officer. See Air Permit application example in appendix. Work with Lexington VAMC Green Environmental Management System (GEMS) coordinator on air permit application. Complete forms so Lexington VAMC can submit to Kentucky DEP, DAQ. The manufacture's generator emission data shall be included in the generator submittal to the VA. Lexington VAMC will need to submit the following forms for the addition of the diesel generators.

- DEP7007A - Generator
- DEP7007N - Stack

Replace Exterior Lighting on Buildings
VAMC LD, Lexington, KY
Project No. 596-12-101

- DEP7007DD - Fuel Storage

2. These forms can be found on the Kentucky DEP, DAQ website
<http://dep.ky.gov/formslibrary/Pages/default.aspx> .

3. Provide the following for the Air Permit submittal:

- Site Plan Showing Stack Data and Location
- Map or Drawing Showing Location
- MSDS for Fuel (Lexington VAMC must use ultra low sulfur, per source wide permit)

4. Provide a description of the onboard fuel storage (quantity, is it double walled, and secondary containment, overfill or overspill) required for the Air Permit submittal with generator submittal.

5. The generator may be ordered when submittal is approved; however, the generator shall not be delivered or installed into EPA approval is granted.

E. Before placement and installation of work subject to tests by testing laboratory retained by Department of Veterans Affairs, the Contractor shall notify the Contracting Officer's Representative in sufficient time to enable testing laboratory personnel to be present at the site in time for proper taking and testing of specimens and field inspection. Such prior notice shall be not less than three work days unless otherwise designated by the Contracting Officer's Representative.

- F. All employees of general contractor and subcontractors shall comply with VA security management program and obtain permission of the VA police, be identified by project and employer, and restricted from unauthorized access.
- G. Prior to commencing work, general contractor shall provide proof that a OSHA certified "competent person" (CP) (29 CFR 1926.20(b)(2)) will maintain a presence at the work site whenever the general or subcontractors are present. The CP shall be approved by the Contracting Officer (CO).
- H. Training:
 - 1. All employees of general contractor or subcontractors shall have the 10-hour OSHA certified Construction Safety course and/or other relevant competency training, as determined by VA Contracting Officer Representative (COR) with input from the ICRA team. The general contractor's competent person (CP) shall have the 30-Hour OSHA certified Construction Safety course and/or other relevant competency training, as determined by the COR with input from the ICRA team.
 - 2. Submit training records of all such employees for approval before the start of work. In addition, submit resume of CP to CO for approval.
 - 3. Contractor shall submit an initial list of names of Contractor and subcontractor employees who will be completing work on the site along with a copy of the card and/or training certificate issued following employees' completion of 10-hour (30-hour for CP) OSHA certified Construction Safety course and/or other relevant competency training.
 - a. Subcontractor initial employee name list and corresponding completion card and/or certificate shall include employees at any and all levels of subcontract.
 - b. Contractor shall update this list when changes occur. Contractor is responsible for subcontractor updates. Contractor shall provide subsequent list(s) of names four (4) weeks in advance of

additional employees reporting to the work site. Subsequent list(s) of names shall consist of contractor and/or subcontractor employee(s) names with a copy of the card and/or training certificate issued following employee's completion of 10-hour OSHA certified Construction Safety course and/or other relevant competency training.

4. A construction kick-off orientation meeting shall be coordinated with the Project Manager in advance of construction activities. This meeting shall contain, at a minimum, the following agenda items: Fire Safety orientation to the specific site, Infection control training per the specific project, and other site and/or project specific items. The meeting will be held in the physical location of the project if possible.

1.2 STATEMENT OF BID ITEM(S)

- A. BID ITEM 1: All work (furnish all labor, tools, materials, and expertise) to complete Project 596-12-101 Replace Exterior Lighting on Buildings in accordance with the drawings and specifications. (Number of days for completion = 180 days).
- B. BID ITEM 2: All work in ITEM 1 less the emergency generator and lighting work associated with Buildings 22, 37, 39 & 47 at the rear of the campus as shown on sheets EL004 and the single-line diagram shown on sheet EL007.

1.3 SPECIFICATIONS AND DRAWINGS FOR CONTRACTOR

- A. The contractor is responsible for producing all specifications and drawings at his or her own expense from the bid documents that are necessary to perform the work.

1.4 CONSTRUCTION SECURITY REQUIREMENTS

- A. Security:
 1. Contractor's superintendent shall sign in daily at the start of work but no later than 8:00 am. Contractor's superintendent shall sign in to the Contractor log in the Engineering Office located in the 2250 Leestown Road, Lexington, KY, Leestown Division (LD) Building 2, 2nd floor at reception area near center of floor. Contractor shall

sign out daily at the same location. Contractor work outside of administrative hours shall be as scheduled with the COR.

Contractor's superintendent sign-in/out shall represent all Contractor and/or subcontractor employees on site for work; all other Contractor and/or subcontractor employees are not required to sign in/out.

2. Contractor shall provide a daily log for each day work takes place on site. Daily log shall include name of Contractor's superintendent, name(s) of other Contractor employees, listing of subcontractor(s), names(s) of subcontractor employees, identification of the work performed, work hours, list of rooms accessed and any notes required to convey extent of activities.
3. All employees of General Contractor and subcontractors shall comply with VA security management program and obtain permission of the VA police, be identified by project and employer, and restricted from unauthorized access.
4. Only employees of the Contractor or subcontractor(s) with VA-provided ID badges shall work on the site. To obtain badge, the contractor shall attend a Contractor Orientation Meeting held each Monday and Tuesday at 8:00 am at Leestown Division, Building 2, 2nd Floor, Engineering Offices, except for federal holidays. Contractor shall present the following for each employee that attends the Orientation: two forms of US Government Issued ID (e.g. Driver's License, Personal Identification Card, Social Security Card, US Passport, Worker's Visa, etc.)- one has to be a picture ID; 10-Hour OSHA card or certificate from a certified OSHA instructor - 30-Hour OSHA card or certificate for general contractor's competent person; and, the completed employee package described below.
 - a) Employees shall comply with VA Security Management Program. In order to comply with the Security Management Program the following actions are necessary:
 - i) Submit to COR a completed employee package at the orientation consisting of the following:
 - (1) Completed Orientation Information Sheet.

Replace Exterior Lighting on Buildings
VAMC LD, Lexington, KY
Project No. 596-12-101

- (2) Contractor Orientation Checklist with top information portion completed.
- (3) VA Form 0711 Request For One-VA Identification Card with Section I Part A Completed.
- (4) Copy of 10-Hour OSHA card or certificate from a certified OSHA instructor - 30-Hour OSHA card or certificate for general contractor's competent person.
- (5) Copies the two forms of Government IDs.

B. Security Plan:

- 1. Contractor shall provide a security plan to the Contracting Officer for approval prior to performing work.
- 2. Elements of the plan must address the following:
 - a. The security plan defines both physical and administrative security procedures that will remain effective for the entire duration of the project. This shall include key control.
 - b. The General Contractor is responsible for assuring that all sub-contractors working on the project and their employees also comply with these regulations.

C. Security Procedures:

- 1. General Contractor's employees shall not enter the project site without appropriate badge. They may also be subject to inspection of their personal effects when entering or leaving the project site.
- 2. For working outside the "regular hours" as defined in the contract, The General Contractor shall give 3-days notice to the Contracting Officer so that security escort arrangements can be provided for the employees. This notice is separate from any notices required for utility shutdown described later in this section.
- 3. No photography of VA premises is allowed without written permission of the Contracting Officer.

Replace Exterior Lighting on Buildings
VAMC LD, Lexington, KY
Project No. 596-12-101

4. VA reserves the right to close down or shut down the project site and order General Contractor's employees off the premises in the event of a national emergency. The General Contractor may return to the site only with the written approval of the Contracting Officer.

D. Guards: Not used for this Contract.

E. Key Control:

1. Only the General Contractor will be issued keys for access to areas of the Medical Center in conjunction with construction work. The General Contractor is responsible for all keys issued to him, including any keys he distributes to subcontractors.
2. All keys issued to the General Contractor must be returned and accounted for by the Contracting Officer prior to processing final payment. The General Contractor will inform his personnel and subcontractors of the importance of accounting for all keys issued by this Medical Center.
3. The Contractor shall, at any time during the contract, be able to show all keys issued for the visual inspection and validation within two (2) business days of request.
4. Contractor is responsible for replacing all keys and cores affected because of the loss of keys by Contractor personnel prior to final inspection of the project and subsequent close-out of the contract. Replacement of all keys and cores affected shall be accomplished by separate contract between Contractor and Best Lock Co. and shall not be charged to VA.
5. The General Contractor shall provide duplicate keys and lock combinations to the Contracting Officer's Representative for the purpose of security inspections of every area of project including tool boxes and parked machines and take any emergency action.
6. The General Contractor shall turn over all permanent lock cylinders to the VA locksmith for permanent installation.

F. Document Control:

1. Before starting any work, the General Contractor/Sub Contractors shall submit an electronic security memorandum describing the approach to following goals and maintaining confidentiality of "sensitive information".
2. The General Contractor is responsible for safekeeping of all drawings, project manual and other project information. This information shall be shared only with those with a specific need to accomplish the project.
4. Certain documents, sketches, videos or photographs and drawings may be marked "Law Enforcement Sensitive" or "Sensitive Unclassified". Secure such information in separate containers and limit the access to only those who will need it for the project. Return the information to the Contracting Officer upon request.
5. These security documents shall not be removed or transmitted from the project site without the written approval of Contracting Officer.
6. All paper waste or electronic media such as CD's and diskettes shall be shredded and destroyed in a manner acceptable to the VA.
7. Notify Contracting Officer and Site Security Officer immediately when there is a loss or compromise of "sensitive information".
8. All electronic information shall be stored in specified location following VA standards and procedures using an Engineering Document Management Software (EDMS).
 - a. Security, access and maintenance of all project drawings, both scanned and electronic shall be performed and tracked through the EDMS system.
 - b. "Sensitive information" including drawings and other documents may be attached to e-mail provided all VA encryption procedures are followed.

G. Motor Vehicle Restrictions

Replace Exterior Lighting on Buildings
VAMC LD, Lexington, KY
Project No. 596-12-101

1. Vehicle authorization request shall be required for any vehicle entering the site and such request shall be submitted 24 hours before the date and time of access. Access shall be restricted to picking up and dropping off materials and supplies.
2. Motor Vehicle Restrictions:
 - a. Contractor and subcontractor employee vehicles shall not park in spaces identified as reserved for patients and visitors; contract employees do not meet the definition of patient or visitor.
 - b. Two separate permits shall be issued for General Contractor and its employees for parking in designated areas only. Additional on-site parking will not be provided. Coordinate issuance of permits with COR.

1.5 FIRE SAFETY

A. Applicable Publications: Publications listed below form part of this Article to extent referenced. Publications are referenced in text by basic designations only.

1. American Society for Testing and Materials (ASTM):

E84-2008.....Surface Burning Characteristics of Building
Materials

2. National Fire Protection Association (NFPA):

10-2006.....Standard for Portable Fire Extinguishers

30-2007.....Flammable and Combustible Liquids Code

51B-2003.....Standard for Fire Prevention During Welding,
Cutting and Other Hot Work

70-2007.....National Electrical Code

241-2004.....Standard for Safeguarding Construction,
Alteration, and Demolition Operations

3. Occupational Safety and Health Administration (OSHA):

29 CFR 1926.....Safety and Health Regulations for Construction

- B. Fire Safety Plan: Establish and maintain a fire protection program in accordance with 29 CFR 1926. Prior to start of work, prepare a plan detailing project-specific fire safety measures, including periodic status reports, and submit to COR and Facility Safety Manager for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES. Prior to any worker for the contractor or subcontractors beginning work, they shall undergo a safety briefing provided by the general contractor's competent person per OSHA requirements. This briefing shall include information on the construction limits, VAMC safety guidelines, means of egress, break areas, work hours, smoking policy, locations of restrooms, use of VAMC equipment, etc. Documentation shall be provided to the COTR that individuals have undergone contractor's safety briefing.
- C. Site and Building Access: Maintain free and unobstructed access to facility emergency services and for fire, police and other emergency response forces in accordance with NFPA 241.
- D. Separate temporary facilities, such as trailers, storage sheds, and dumpsters, from existing buildings and new construction by distances in accordance with NFPA 241. For small facilities with less than 6 m (20 feet) exposing overall length, separate by 3m (10 feet).
- E. Temporary Construction Partitions:
1. Install and maintain temporary construction partitions to provide smoke-tight separations between construction areas, the areas that are described in phasing requirements, and adjoining areas. Construct partitions of gypsum board or treated plywood (flame spread rating of 25 or less in accordance with ASTM E84) on both sides of fire retardant treated wood or metal steel studs. Extend the partitions through suspended ceilings to floor slab deck or roof. Seal joints and penetrations. At door openings, install Class C, ¾ hour fire/smoke rated doors with self-closing devices.

Replace Exterior Lighting on Buildings
VAMC LD, Lexington, KY
Project No. 596-12-101

2. Install two-hour temporary construction partitions as required to maintain integrity of existing exit stair enclosures, exit passageways, fire-rated enclosures of hazardous areas, horizontal exits, smoke barriers, vertical shafts and openings enclosures.
 3. Close openings in smoke barriers and fire-rated construction to maintain fire ratings. Seal penetrations with listed through-penetration firestop materials in accordance with Section 07 84 00, FIRESTOPPING.
- F. Temporary Heating and Electrical: Install, use and maintain installations in accordance with 29 CFR 1926, NFPA 241 and NFPA 70.
- G. Means of Egress: Do not block exiting for occupied buildings, including paths from exits to roads. Minimize disruptions and coordinate with Project Engineer and facility Safety Manager.
- H. Egress Routes for Construction Workers: Maintain free and unobstructed egress. Inspect daily. Report findings and corrective actions weekly to Project Engineer (COR) and facility Safety Manager.
- I. Fire Extinguishers: Provide and maintain extinguishers in construction areas and temporary storage areas in accordance with 29 CFR 1926, NFPA 241 and NFPA 10.
- J. Flammable and Combustible Liquids: Store, dispense and use liquids in accordance with 29 CFR 1926, NFPA 241 and NFPA 30.
- K. Sprinklers: Install, test and activate new automatic sprinklers prior to removing existing sprinklers.
- L. Existing Fire Protection: Do not impair automatic sprinklers, smoke and heat detection, and fire alarm systems, except for portions immediately under construction, and temporarily for connections. Provide fire watch for impairments more than 4 hours in a 24-hour period. Request interruptions in accordance with Article, OPERATIONS AND STORAGE AREAS, and coordinate with V.A. Engineer and facility Safety Manager Officer. All existing or temporary fire protection systems (fire alarms, sprinklers) located in construction areas shall be tested as coordinated with the medical center. Parameters for the testing and

results of any tests performed shall be recorded by the medical center and copies provided to the COTR (COR).

- M. Smoke Detectors: Prevent accidental operation. Contractor shall not bag or cover any active smoke detector. See paragraphs U and W below.
- N. Hot Work: Perform and safeguard hot work operations in accordance with NFPA 241 and NFPA 51B. Coordinate with Project Engineer Obtain permits from facility Safety Officer at least 72 hours in advance. Designate contractor's responsible project-site fire prevention program manager to permit hot work. **Hot work permits shall be submitted using the "Permit for Cutting and Welding with Portable Gas or Arc Equipment," which is attached to the end of this section (2 pages).** Contractor shall abide by the instructions on the form and submit the signed form once completed with the item daily. In general permission for certain types of work is only valid for one day.
- O. Fire Hazard Prevention and Safety Inspections: Inspect entire construction areas weekly. Coordinate with, and report findings and corrective actions weekly to Project Engineer and facility Safety Officer.
- P. Smoking: Smoking is prohibited in and adjacent to construction areas inside existing buildings and additions under construction. In separate and detached buildings under construction, smoking is prohibited except in designated smoking rest areas.
- Q. Dispose of waste and debris in accordance with NFPA 241. Remove from buildings daily. Recycle material in accordance with Lexington VAMC Green Environmental Management System (GEMS) policy. Report recycled items to COR monthly in Excel spreadsheet provided by COR or GEMS coordinator.
- R. Perform other construction, alteration and demolition operations in accordance with 29 CFR 1926.
- S. If required, submit documentation to the Contracting Officer's Representative that personnel have been trained in the fire safety aspects of working in areas with impaired structural or compartmentalization features.

- T. Contractor shall maintain a binder or file of all Material Safety Data Sheets for all products brought on site. Contractor shall inform the Project Manager (COR) in writing of the location of this file or binder. Contractor shall update the binder or file as changes occur to products brought on site.
- U. **Contractor shall maintain sprinkler systems and smoke detection systems as indicated on drawings. Contractor shall maintain a minimum of one (1) active smoke detector within the defined construction area. Contractor shall ensure non-activation of the active smoke detector during daily Contractor activities. Smoke detectors shall be disconnected and safely stored per Lexington VA maintenance procedures when required by construction activities and to prevent smoke detector damage. Contractor shall not bag or cover any active smoke detector. Contractor shall ensure smoke detector activation at the end of Contractor's daily work shift. Contractor shall not leave the site until the active smoke detector is providing smoke detection coverage. Contractor shall not disconnect or remove all sprinkler piping and sprinkler coverage without having at least minimal smoke detector coverage. Contractor shall coordinate sprinkler piping and sprinkler head demolition and new installation activities with the Project Manager. Contractor shall ensure an Interim Life Safety Measures (ILSM) is in place for any change or interruption of the Life Safety Systems (detection, notification, suppression or evacuation) by coordinating with the COR.**
- V. **Fire and Smoke Barrier Penetrations:** The contractor shall obtain a penetration permit from the VAMC prior to disturbing the integrity of any smoke and/or fire barrier. The permit must be posted at the work site until completion of the work and verification of penetration closure. After the associated work is complete, the penetration must be sealed. An identification sticker shall be placed at the sealed penetration to indicate date, material, and permit number for the seal. **The "Fire and Smoke Barrier Penetration Permit" form (3 pages), attached at the end of this section shall be used to fulfill this requirement.** The 3rd page of the attachment is a sample of the identification sticker.

- W. Interim Life Safety Measures (ILSMs): The contractor shall abide by the applicable requirements of NFPA 101 (Life Safety Code) and VAMC policy concerning ILSMs. An ILSM shall be implemented when any component of the life safety system is taken out of service for four or more hours (coordinated with the COR). Components of the life safety system include any portion of the fire suppression system (water, flow alarms, pump, piping, sprinkler heads or fire extinguishers), smoke detectors, heat detectors, pull stations, alarms, alarm panel, fire doors, exit stairwells, exit signs, exit passageways, exit discharge (outside the building path), smoke or fire dampers, or any utility system supporting a component of the life safety system (emergency generator or HVAC systems). **A copy of the "Construction Project Interim Life Safety Requirements" ILSM form (3 pages) and decision matrix is attached at the end of this section.** The contractor shall coordinate ILSM's with the COR and comply with the approved ILSM.

1.6 OPERATIONS AND STORAGE AREAS

- A. The Contractor shall confine all operations (including storage of materials) on Government premises to areas authorized or approved by the Contracting Officer. The Contractor shall hold and save the Government, its officers and agents, free and harmless from liability of any nature occasioned by the Contractor's performance.
- B. Temporary buildings will not be authorized under this contract.
- C. The Contractor shall, under regulations prescribed by the Contracting Officer, use only established roadways, or use temporary roadways constructed by the Contractor when and as authorized by the Contracting Officer. When materials are transported in prosecuting the work, vehicles shall not be loaded beyond the loading capacity recommended by the manufacturer of the vehicle or prescribed by any Federal, State, or local law or regulation. When it is necessary to cross curbs or sidewalks, the Contractor shall protect them from damage. The Contractor shall repair or pay for the repair of any damaged curbs, sidewalks, or roads.

- D. Working space and space available for storing materials is limited and will be determined by the Contracting Officer's Representative.
- E. Workmen are subject to rules of Medical Center applicable to their conduct.
- F. This Medical Center has adopted a policy for smoke-free environment. No smoking is permitted in any building by employees, house staff, students, visitors or contractors. No smoking is permitted within defined construction areas interior of any building or the roof of any building. No smoking is permitted on any open rooftop of any building. Smoking is permitted by patients in certain designated areas. Contractors may only smoke in those designated areas - and not in staging areas or other spaces.
- G. Execute work so as to interfere as little as possible with normal functioning of Medical Center as a whole, including operations of utility services, fire protection systems and any existing equipment, and with work being done by others. Use of equipment and tools that transmit vibrations and noises through the building structure, are not permitted in buildings that are occupied, during construction, jointly by patients or medical personnel, and Contractor's personnel, except as permitted by Contracting Officer's Representative where required by limited working space.
 - 1. Do not store materials and equipment in other than assigned areas.
 - 2. Schedule delivery of materials and equipment to immediate construction working areas within buildings in use by Department of Veterans Affairs in quantities sufficient for not more than two work days. Provide unobstructed access to Medical Center areas required to remain in operation.
 - 3. Where access by Medical Center personnel to vacated portions of buildings is not required, storage of Contractor's materials and equipment will be permitted subject to fire and safety requirements.
- H. Phasing: To insure such executions, Contractor shall furnish the Contracting Officer's Representative with a schedule of approximate phasing dates on which the Contractor intends to accomplish work in

each specific area of site, building or portion thereof. In addition, Contractor shall notify the Contracting Officer's Representative two weeks in advance of the proposed date of starting work in each specific area of site, building or portion thereof. Arrange phasing dates to insure accomplishment of this work in successive phases mutually agreeable to the COR and Contractor. Contractor shall take all measures and provide all material necessary for protecting existing equipment and property in affected areas of construction against dust and debris, so that equipment and affected areas to be used in the Medical Centers operations will not be hindered. Contractor shall permit access to Department of Veterans Affairs personnel and patients through other construction areas which serve as routes of access to such affected areas and equipment. Coordinate alteration work in areas occupied by Department of Veterans Affairs so that Medical Center operations will continue during the construction period.

- I. Construction Fence: Not required under this contract.
- J. Utilities Services: Maintain existing utility services for Medical Center at all times. Provide temporary facilities, labor, materials, equipment, connections, and utilities to assure uninterrupted services. Where necessary to cut existing water, steam, gases, sewer or air pipes, or conduits, wires, cables, etc. of utility services or of fire protection systems and communications systems (including telephone), they shall be cut and capped at suitable places where shown; or, in absence of such indication, where directed by Contracting Officer's Representative (COR).
 - 1. No utility service such as water, gas, steam, sewers or electricity, or fire protection systems and communications systems may be interrupted without prior approval of Contracting Officer's Representative. **Electrical work shall be accomplished with all affected circuits or equipment de-energized. When an electrical outage cannot be accomplished, work on any energized circuits or equipment shall not commence without the Medical Center Director's prior knowledge and written approval. Refer to specification Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS for additional requirements.**

2. Contractor shall submit a request to interrupt any such services to Contracting Officer's Representative, in writing, **10 BUSINESS DAYS** in advance of proposed interruption. Request shall state reason, date, exact time of, and approximate duration of such interruption. All requests shall include a completed "Utility Systems Service/Outage Notification" form, which is attached to the end of this section.
 3. Contractor will be advised (in writing) of approval of request, or of which other date and/or time such interruption will cause least inconvenience to operations of Medical Center. Interruption time approved by Medical Center may occur at other than Contractor's normal working hours.
 4. Major interruptions of any system must be requested, in writing, at least **15 BUSINESS DAYS** prior to the desired time and shall be performed as directed by the Contracting Officer's Representative.
 5. In case of a contract construction emergency, service will be interrupted on approval of Contracting Officer's Representative. Such approval will be confirmed in writing as soon as practical.
 6. Whenever it is required that a connection fee be paid to a public utility provider for new permanent service to the construction project, for such items as water, sewer, electricity, gas or steam, payment of such fee shall be the responsibility of the Government and not the Contractor.
- L. Abandoned Lines: All service lines such as wires, cables, conduits, ducts, pipes and the like, and their hangers or supports, which are to be abandoned but are not required to be entirely removed, shall be sealed, capped or plugged. The lines shall not be capped in finished areas, but shall be removed and sealed, capped or plugged in ceilings, within furred spaces, in unfinished areas, or within walls or partitions; so that they are completely behind the finished surfaces.
- M. To minimize interference of construction activities with flow of Medical Center traffic, comply with the following:

1. Keep roads, walks and entrances to grounds, to parking and to occupied areas of buildings clear of construction materials, debris and standing construction equipment and vehicles. Wherever excavation for new utility lines cross existing roads, at least one lane must be open to traffic at all times.
 2. Method and scheduling of required cutting, altering and removal of existing roads, walks and entrances must be approved by the Contracting Officer's Representative.
- N. Coordinate the work for this contract with other construction operations as directed by Contracting Officer's Representative. This includes the scheduling of traffic and the use of roadways.
- O. Wireless devices such as cell phones, two-way radios, blackberry-type devices, blue-tooth enabled devices and similar devices capable of transmitting and receiving analog and/or digital signals shall be powered off in restricted areas. These devices may be used in non-restricted areas. Restricted areas are: all locations within buildings except elevator lobbies marked as acceptable for wireless device use, private offices, and defined construction areas.

1.7 ALTERATIONS

- A. Survey: Before any work is started, the Contractor shall make a thorough survey with the COR, of areas of buildings in which alterations occur and areas which are anticipated routes of access, and furnish a report, signed by both, to the Contracting Officer. This report shall list by rooms and spaces:
1. Shall note any discrepancies between drawings and existing conditions at site.
 4. Shall designate areas for working space, materials storage and routes of access to areas within buildings where alterations occur and which have been agreed upon by Contractor and COR.
- B. Any items required by drawings to be either reused or relocated or both, found during this survey to be nonexistent, or in opinion of COR and/or Supply Representative, to be in such condition that their use is impossible or impractical, shall be furnished and/or replaced by

Contractor with new items in accordance with specifications which will be furnished by Government. Provided the contract work is changed by reason of this subparagraph B, the contract will be modified accordingly, under provisions of clause entitled "DIFFERING SITE CONDITIONS" (FAR 52.236-2) and "CHANGES" (FAR 52.243-4 and VAAR 852.236-88) of GENERAL CONDITIONS.

C. Re-Survey: Not required under this contract.

D. Protection: Provide the following protective measures:

1. Temporary protection against damage for portions of existing structures and grounds where work is to be done, materials handled and equipment moved and/or relocated.
2. Protection of interior of existing structures at all times, from damage, dust and weather inclemency. Wherever work is performed, floor surfaces that are to remain in place shall be adequately protected prior to starting work, and this protection shall be maintained intact until all work in the area is completed.

1.8 INFECTION PREVENTION MEASURES

A. Implement the requirements of VAMC's Infection Control Risk Assessment (ICRA) team. ICRA Group may monitor dust in the vicinity of the construction work and require the Contractor to take corrective action immediately if the safe levels are exceeded.

B. Contractor shall submit an initial list of names of Contractor and subcontractor employees who will be completing work on the site along with signatures of each showing completion of project specific Infection Control training.

1. Subcontractor initial employee name list shall include employees at any and all levels of subcontract.
2. Contractor shall update this list when changes occur. Contractor is responsible for subcontractor updates. Contractor shall provide subsequent list(s) of names four (4) weeks in advance of additional employees reporting to the work site. Subsequent list(s) of names shall consist of Contractor and/or subcontractor employee(s) names

with signatures of each showing completion of project specific Infection Control training.

3. Additional project specific Infection Control training information is located in paragraph MEDICAL CENTER INFECTION CONTROL PERMIT AND EDUCATION REQUIREMENTS of this Section as an attachment.
4. This project has been identified as a **Class I** project. However, interior corridors must be enclosed and negative pressure maintained if there is found a need to work inside of corridors of patient care facilities.

C. Establish and maintain a dust control program as part of the contractor's infection preventive measures in accordance with the guidelines provided by ICRA Group as specified here. Prior to start of work, prepare a plan detailing project-specific dust protection measures, including periodic status reports, and submit to Project Engineer and Facility ICRA team for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

1. All personnel involved in the construction or renovation activity shall be educated and trained in infection prevention measures established by the medical center.

D. Medical center Infection Control personnel shall monitor for airborne disease (e.g. aspergillosis) as appropriate during construction. A baseline of conditions may be established by the medical center prior to the start of work and periodically during the construction stage to determine impact of construction activities on indoor air quality. In addition:

1. The COR and VAMC Infection Control personnel shall review pressure differential monitoring documentation to verify that pressure differentials in the construction zone and in the patient-care rooms are appropriate for their settings. The requirement for negative air pressure in the construction zone shall depend on the location and type of activity. Upon notification, the contractor shall implement corrective measures to restore proper pressure differentials as needed.

2. In case of any problem, the medical center, along with assistance from the contractor, shall conduct an environmental assessment to find and eliminate the source.

E. In general, following preventive measures shall be adopted during construction to keep down dust and prevent mold.

1. Dampen debris to keep down dust and provide temporary construction partitions in existing structures where directed by Contracting Officer's Representative. Blank off ducts and diffusers to prevent circulation of dust into occupied areas during construction.
2. Do not perform dust producing tasks within occupied areas without the approval of the Contracting Officer's Representative. For construction in any areas that will remain jointly occupied by the medical Center and Contractor's workers, the Contractor shall:
 - a. Provide dust proof one-hour fire-rated temporary drywall construction barriers to completely separate construction from the operational areas of the hospital in order to contain dirt debris and dust. Barriers shall be sealed and made presentable on hospital occupied side. Install a self-closing rated door in a metal frame, commensurate with the partition, to allow worker access. Maintain negative air at all times. A fire retardant polystyrene, 6-mil thick or greater plastic barrier meeting local fire codes may be used where dust control is the only hazard, and an agreement is reached with the Contracting Officer's Representative and Medical Center.
 - b. HEPA filtration is required where the exhaust dust may reenter the breathing zone. Contractor shall verify that construction exhaust to exterior is not reintroduced to the medical center through intake vents, or building openings. Install HEPA (High Efficiency Particulate Accumulator) filter vacuum system rated at 95% capture of 0.3 microns including pollen, mold spores and dust particles. Insure continuous negative air pressures occurring within the work area. HEPA filters should have ASHRAE 85 or other prefilter to extend the useful life of the HEPA. Provide both primary and secondary filtrations units. Exhaust hoses shall be

heavy duty, flexible steel reinforced and exhausted so that dust is not reintroduced to the medical center.

- c. Adhesive Walk-off/Carpet Walk-off Mats, minimum 600mm x 900mm (24" x 36"), shall be used at all interior transitions from the construction area to occupied medical center area. These mats shall be changed as often as required to maintain clean work areas directly outside construction area at all times.
- d. Vacuum and wet mop all transition areas from construction to the occupied medical center at the end of each workday. Vacuum shall utilize HEPA filtration. Maintain surrounding area frequently. Remove debris as they are created. Transport these outside the construction area in containers with tightly fitting lids.
- e. The contractor shall not haul debris through patient-care areas without prior approval of the Contracting Officer's Representative and the Medical Center. When, approved, debris shall be hauled in enclosed dust proof containers or wrapped in plastic and sealed with duct tape. No sharp objects should be allowed to cut through the plastic. Wipe down the exterior of the containers with a damp rag to remove dust. All equipment, tools, material, etc. transported through occupied areas shall be made free from dust and moisture by vacuuming and wipe down.
- f. Using a HEPA vacuum, clean inside the barrier and vacuum ceiling tile prior to replacement. Any ceiling access panels opened for investigation beyond sealed areas shall be sealed immediately when unattended.
- g. There shall be no standing water during construction. This includes water in equipment drip pans and open containers within the construction areas. All accidental spills must be cleaned up and dried within 12 hours. Remove and dispose of porous materials that remain damp for more than 72 hours.
- h. At completion, remove construction barriers and ceiling protection carefully, outside of normal work hours. Vacuum and clean all surfaces free of dust after the removal.

F. Final Cleanup:

1. Upon completion of project, or as work progresses, remove all construction debris from above ceiling, vertical shafts and utility chases that have been part of the construction.
2. Perform HEPA vacuum cleaning of all surfaces in the construction area. This includes walls, ceilings, cabinets, furniture (built-in or free standing), partitions, flooring, etc.
3. All new air ducts shall be cleaned prior to final inspection.

G. MEDICAL CENTER MINIMUM INFECTION CONTROL PERMIT AND EDUCATION REQUIREMENTS:

1. During Class 1 Construction Projects:

- a. Dress: Appropriate for area (i.e. shoe covers, etc., in OR).
- b. Ventilation: Execute work by methods to minimize raising dust.
- c. Barriers: Use care removing ceiling tiles, clean up disturbed dust immediately by HEPA (defined as one capturing 99.97% of particles ≥ 0.3 microns in size) vacuuming and/or wet mopping. Immediately replace any ceiling tiles displaced for visual inspection or replacement. No dust tracks outside work zone.
- d. Debris: Remove from work site in a closed/sealed container.
- e. UPON COMPLETION OF PROJECT:
 - i) Damp-wipe tools when removed from the work site.
 - ii) Clean work area upon completion of task.

1.9 DISPOSAL AND RETENTION

A. Materials and equipment accruing from work removed and from demolition of buildings or structures, or parts thereof, shall be disposed of as follows:

1. Reserved items which are to remain property of the Government are identified by attached tags or noted on drawings or in specifications or notified by COR as items to be stored. Items that

- remain property of the Government shall be removed or dislodged from present locations in such a manner as to prevent damage which would be detrimental to re-installation and reuse. Store such items where directed by COR.
2. Items not reserved shall become property of the Contractor and be removed by Contractor from Medical Center.
 3. Items of portable equipment and furnishings located in rooms and spaces in which work is to be done under this contract shall remain the property of the Government. When rooms and spaces are vacated by the Department of Veterans Affairs during the alteration period, such items which are NOT required by drawings and specifications to be either relocated or reused will be removed by the Government in advance of work to avoid interfering with Contractor's operation.

1.10 PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS

- A. The Contractor shall preserve and protect all structures, equipment, and vegetation (such as trees, shrubs, and grass) on or adjacent to the work site, which are not to be removed and which do not unreasonably interfere with the work required under this contract. The Contractor shall only remove trees when specifically authorized to do so, and shall avoid damaging vegetation that will remain in place. If any limbs or branches of trees are broken during contract performance, or by the careless operation of equipment, or by workmen, the Contractor shall trim those limbs or branches with a clean cut and paint the cut with a tree-pruning compound as directed by the Contracting Officer's Representative.
- B. The Contractor shall protect from damage all existing improvements and utilities at or near the work site and on adjacent property of a third party, the locations of which are made known to or should be known by the Contractor. The Contractor shall repair any damage to those facilities, including those that are the property of a third party, resulting from failure to comply with the requirements of this contract or failure to exercise reasonable care in performing the work. If the Contractor fails or refuses to repair the damage promptly, the

Contracting Officer's Representative may have the necessary work performed and charge the cost to the Contractor.

1.11 RESTORATION

- A. Remove, cut, alter, replace, patch and repair existing work as necessary to install new work. Except as otherwise shown or specified, do not cut, alter or remove any structural work, and do not disturb any ducts, plumbing, steam, gas, or electric work without approval of the COTR. Existing work to be altered or extended and that is found to be defective in any way, shall be reported to the COR before it is disturbed. Materials and workmanship used in restoring work shall conform in type and quality to that of original existing construction, except as otherwise shown or specified.
- B. Upon completion of contract, deliver work complete and undamaged. Existing work (walls, ceilings, partitions, floors, mechanical and electrical work, lawns, paving, roads, walks, etc.) disturbed or removed as a result of performing required new work, shall be patched, repaired, reinstalled, or replaced with new work, and refinished and left in as good condition as existed before commencing work.
- C. At Contractor's own expense, Contractor shall immediately restore to service and repair any damage caused by Contractor's workmen to existing piping and conduits, wires, cables, etc., of utility services or of fire protection systems and communications systems (including telephone) which are indicated on drawings and which are not scheduled for discontinuance or abandonment.
- D. Expense of repairs to such utilities and systems not shown on drawings or locations of which are unknown will be covered by adjustment to contract time and price in accordance with clause entitled "CHANGES" (FAR 52.243-4 and VAAR 852.236-88) and "DIFFERING SITE CONDITIONS" (FAR 52.236-2).

1.12 PHYSICAL DATA

- A. Data and information furnished or referred to below is for the Contractor's information. The Government shall not be responsible for any interpretation of or conclusion drawn from the data or information by the Contractor.

Replace Exterior Lighting on Buildings
VAMC LD, Lexington, KY
Project No. 596-12-101

1.13 NOT USED

1.14 NOT USED

1.15 AS-BUILT DRAWINGS

- A. The contractor shall maintain two full size sets of as-built drawings which will be kept current during construction of the project, to include all contract changes, modifications and clarifications.
- B. All variations shall be shown in the same general detail as used in the contract drawings. To insure compliance, as-built drawings shall be made available for the COR's review, as often as requested.
- C. Contractor shall deliver two approved completed sets of as-built drawings to the Contracting Officer's Representative within 15 calendar days after each completed phase and after the acceptance of the project by the Contracting Officer's Representative.
- D. Paragraphs A, B, & C shall also apply to all shop drawings.

1.16 USE OF ROADWAYS

- A. For hauling, use only established public roads and roads on Medical Center property and, when authorized by the Contracting Officer's Representative, such temporary roads which are necessary in the performance of contract work. Temporary roads shall be constructed by the Contractor at Contractor's expense. When necessary to cross curbing, sidewalks, or similar construction, they must be protected by well-constructed bridges.
- B. When new permanent roads are to be a part of this contract, Contractor may construct them immediately for use to facilitate building operations. These roads may be used by all who have business thereon within zone of building operations.
- C. When certain buildings (or parts of certain buildings) are required to be completed in advance of general date of completion, all roads leading thereto must be completed and available for use at time set for completion of such buildings or parts thereof.

1.17 NOT USED

1.18 TEMPORARY USE OF MECHANICAL AND ELECTRICAL EQUIPMENT

- A. Use of new installed mechanical and electrical equipment to provide heat, ventilation, plumbing, light and power will be permitted subject to compliance with the following provisions:
1. Permission to use each unit or system must be given by COR. If the equipment is not installed and maintained in accordance with the following provisions, the COR will withdraw permission for use of the equipment.
 2. Electrical installations used by the equipment shall be completed in accordance with the drawings and specifications to prevent damage to the equipment and the electrical systems, i.e. transformers, relays, circuit breakers, fuses, conductors, motor controllers and their overload elements shall be properly sized, coordinated and adjusted. Voltage supplied to each item of equipment shall be verified to be correct and it shall be determined that motors are not overloaded. The electrical equipment shall be thoroughly cleaned before using it and again immediately before final inspection including vacuum cleaning and wiping clean interior and exterior surfaces.
 3. Units shall be properly lubricated, balanced, and aligned. Vibrations must be eliminated.
 4. Automatic temperature control systems for preheat coils shall function properly and all safety controls shall function to prevent coil freeze-up damage.
 5. The air filtering system utilized shall be that which is designed for the system when complete, and all filter elements shall be replaced at completion of construction and prior to testing and balancing of system.
 6. All components of heat production and distribution system, metering equipment, condensate returns, and other auxiliary facilities used in temporary service shall be cleaned prior to use; maintained to prevent corrosion internally and externally during use; and cleaned, maintained and inspected prior to acceptance by the Government.

Replace Exterior Lighting on Buildings
VAMC LD, Lexington, KY
Project No. 596-12-101

Boilers, pumps, feedwater heaters and auxiliary equipment must be operated as a complete system and be fully maintained by operating personnel. Boiler water must be given complete and continuous chemical treatment.

B. Prior to final inspection, the equipment or parts used which show wear and tear beyond normal, shall be replaced with identical replacements, at no additional cost to the Government.

C. This paragraph shall not reduce the requirements of the mechanical and electrical specifications sections.

1.19 TEMPORARY USE OF EXISTING ELEVATORS

A. Contractor will not generally be allowed the use of existing elevators. Outside type hoist shall be used by Contractor for transporting materials and equipment. Upon approval of the COR and during non-business hours, the Contractor may be allowed occasional use of the elevators to transport larger items.

1.20 NOT USED IN THIS CONTRACT.

1.21 TEMPORARY TOILETS

A. Provide where directed, (for use of all Contractor's workmen) ample temporary sanitary toilet accommodations with suitable sewer and water connections; or, when approved by Contracting Officer's Representative, provide suitable dry closets where directed. Keep such places clean and free from flies, and all connections and appliances connected therewith are to be removed prior to completion of contract, and premises left perfectly clean.

B. Contractor may have for use of Contractor's workmen, such toilet accommodations as may be assigned to Contractor by Medical Center. Contractor shall keep such places clean and be responsible for any damage done thereto by Contractor's workmen. Failure to maintain satisfactory condition in toilets will deprive Contractor of the privilege to use such toilets.

1.22 AVAILABILITY AND USE OF UTILITY SERVICES

A. The Government shall make all reasonably required amounts of utilities available to the Contractor from existing outlets and supplies, as

specified in the contract for power tools and COR approved equipment. The amount to be paid by the Contractor for chargeable electrical services shall be the prevailing rates charged to the Government. The Contractor shall carefully conserve any utilities furnished without charge. Contractor shall obtain electricity from local utility for staging areas and trailers.

1.23 NOT USED

1.24 TESTS

- A. Pre-test mechanical and electrical equipment and systems and make corrections required for proper operation of such systems before requesting final tests. Final test will not be conducted unless pre-tested.
- B. Conduct final tests required in various sections of specifications in presence of an authorized representative of the Contracting Officer. Contractor shall furnish all labor, materials, equipment, instruments, and forms, to conduct and record such tests.
- C. Mechanical and electrical systems shall be balanced, controlled and coordinated. A system is defined as the entire complex which must be coordinated to work together during normal operation to produce results for which the system is designed. For example, air conditioning supply air is only one part of entire system which provides comfort conditions for a building. Other related components are return air, exhaust air, steam, chilled water, refrigerant, hot water, controls and electricity, etc. Another example of a complex which involves several components of different disciplines is a boiler installation. Efficient and acceptable boiler operation depends upon the coordination and proper operation of fuel, combustion air, controls, steam, feedwater, condensate and other related components.
- D. All related components as defined above shall be functioning when any system component is tested. Tests shall be completed within a reasonably short period of time during which operating and environmental conditions remain reasonably constant.

- E. Individual test result of any component, where required, will only be accepted when submitted with the test results of related components and of the entire system.

1.25 INSTRUCTIONS

- A. Contractor shall furnish Maintenance and Operating manuals and verbal instructions when required by the various sections of the specifications and as hereinafter specified.
- B. Manuals: Maintenance and operating manuals (four bound copies and one compact disc) for each separate piece of equipment shall be delivered to the COTR coincidental with the delivery of the equipment to the job site. Manuals shall be complete, detailed guides for the maintenance and operation of equipment. They shall include complete information necessary for starting, adjusting, maintaining in continuous operation for long periods of time and dismantling and reassembling of the complete units and sub-assembly components. Manuals shall include an index covering all component parts clearly cross-referenced to diagrams and illustrations. Illustrations shall include "exploded" views showing and identifying each separate item. Emphasis shall be placed on the use of special tools and instruments. The function of each piece of equipment, component, accessory and control shall be clearly and thoroughly explained. All necessary precautions for the operation of the equipment and the reason for each precaution shall be clearly set forth. Manuals must reference the exact model, style and size of the piece of equipment and system being furnished. Manuals referencing equipment similar to but of a different model, style, and size than that furnished will not be accepted.
- C. Instructions: Contractor shall provide qualified, factory-trained manufacturers' representatives to give detailed instructions to assigned Department of Veterans Affairs personnel in the operation and complete maintenance for each piece of equipment. All such training will be at the job site. These requirements are more specifically detailed in the various technical sections. Instructions for different items of equipment that are component parts of a complete system, shall be given in an integrated, progressive manner. All instructors for every piece of component equipment in a system shall be available until

instructions for all items included in the system have been completed. This is to assure proper instruction in the operation of inter-related systems. All instruction periods shall be at such times as scheduled by the Contracting Officer's Representative and shall be considered concluded only when the Contracting Officer's Representative is satisfied in regard to complete and thorough coverage. The Department of Veterans Affairs reserves the right to request the removal of, and substitution for, any instructor who, in the opinion of the Contracting Officer's Representative, does not demonstrate sufficient qualifications in accordance with requirements for instructors above.

1.26 NOT USED

1.27 RELOCATED EQUIPMENT

- A. Contractor shall disconnect, dismantle as necessary, remove and reinstall in new location, all existing equipment indicated to be relocated by the Contractor.
- B. Perform relocation of such equipment or items at such times and in such a manner as directed by the Contracting Officer's Representative.
- C. Suitably cap existing service lines, such as steam, condensate return, water, drain, gas, air, vacuum and/or electrical, whenever such lines are disconnected from equipment to be relocated. Remove abandoned lines in finished areas and cap as specified.
- D. Provide all mechanical and electrical service connections, fittings, fastenings and any other materials necessary for assembly and installation of relocated equipment; and leave such equipment in proper operating condition.
- E. Contractor shall employ services of an installation engineer, who is an authorized representative of the manufacturer of this equipment to supervise assembly and installation of equipment, required to be relocated.
- F. All service lines such as noted above for relocated equipment shall be in place at point of relocation ready for use before any existing equipment is disconnected. Make relocated existing equipment ready for operation or use immediately after reinstallation.

Replace Exterior Lighting on Buildings
VAMC LD, Lexington, KY
Project No. 596-12-101

1.28 NOT USED

1.29 NOT USED

1.30 SAFETY SIGN

- A. Provide a Safety Sign where directed by Contracting Officer's Representative. Face of sign shall be 19 mm (3/4 inch) thick exterior grade plywood. Provide two 100 mm by 100 mm (four by four inch) posts extending full height of sign and 900 mm (three feet) into ground. Set bottom of sign level at 1200 mm (four feet) above ground.
- B. Paint all surfaces of Safety Sign and posts with one prime coat and two coats of white gloss paint. Letters and design shall be painted with gloss paint of colors noted.
- C. Maintain sign and remove it when directed by COR.
- D. Detail Drawing Number 45 of safety sign showing required legend and other characteristics of sign is shown in contract documents.
- E. Post the number of accident free days on a daily basis.

1.31 NOT USED

1.32 NOT USED

1.33 HISTORIC PRESERVATION

- A. Where the Contractor or any of the Contractor's employees, prior to, or during the construction work, are advised of or discover any possible archeological, historical and/or cultural resources, the Contractor shall immediately notify the Contracting Officer's Representative verbally, and then with a written follow up.

1.34 MINIMUM HOURLY RATES OF WAGES

- A. Refer to the Solicitation , General Conditions, and elsewhere for details and requirements regarding "Labor Standards Provisions" as required by the FAR and VAAR. ~~The following wage determination of the Secretary of Labor shall be applicable to this project in accordance with the Davis-Bacon Act as set forth under form titled, "Labor Standards Provisions", General Decision Number: KY20100006 03/12/2010-KY6.~~

1.35 QUALITY PLAN

- A. The Contractor shall develop a quality plan to address all aspects of construction quality assurance for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES. The plan shall be submitted not later than 21-days after Notice to Proceed. An approved plan, by the COR/VA Project Manager, shall be in place before construction begins.
- B. The Quality Plan shall indentify the Prime Contractor's on-site quality manager. The quality manager may be the Superintendent if qualified. The Prime Contractor's on-site quality manager shall oversee the Prime Contractor's and Subcontractor's work and assure the work is in compliance with national code, VA specifications, drawings and other contract requirements.
- C. The Quality Plan shall be "ever green" and can be updated as needed with the approval of the Contractor and COR.
- D. In the plan, the Contractor shall identify the process for flowing down of drawings, specifications and requirements to subcontractors. The contractor shall review all requirements with the subcontractors before start of construction. All workers shall be licensed by the State of Kentucky as required by state law.
- E. All Subcontractors shall be identified in the plan and have an on-site quality manager (trade expert). The subcontractor's quality manager may be the foreman if qualified. The quality plan shall identify the prime contractor's action if the subcontractor's work does not meet national code, VA specifications, drawings and other contract requirements. The prime Contractor shall report to COR all instances subcontractor noncompliance. The subcontractor shall stop work after the third instance of a major noncompliance.
- F. The Prime Contractor shall outline the process for completing their Punch List. The process shall identify in the plan a process of how each requirement specified on the drawings, drawing notes, and specifications are complied with. The Prime Contractor shall submit a formal letter to the Contracting Officer (CO) requesting a VA Punch List. The letter shall state that all national code, VA specifications, drawings and other contract requirements are complied

Replace Exterior Lighting on Buildings

VAMC LD, Lexington, KY

Project No. 596-12-101

and include a copy of the Prime Contractor's punch list. The letter shall not be submitted before the Prime Contractor has completed their punch list and all issues identified are resolved.

Replace Exterior Lighting on Buildings
VAMC LD, Lexington, KY
Project No. 596-12-101

APPENDICES

Note: Forms with VAMC policy applicable to this project for specification section follow on next page. These are subject to change and newer versions shall be obtained from COR.

Replace Exterior Lighting on Buildings
VAMC LD, Lexington, KY
Project No. 596-12-101

ATTACHMENT A - PERMIT FOR CUTTING AND WELDING WITH PORTABLE GAS OR ARC EQUIPMENT

DATE: _____

BUILDING: _____

DEPT.: _____

WORK TO BE DONE: _____

SPECIAL PRECAUTIONS: _____

IS FIRE WATCH REQUIRED? _____

LOCATION WHERE THIS WORK IS TO BE DONE HAS BEEN EXAMINED, NECESSARY PRECAUTIONS TAKEN
AND PERMISSION IS GRANTED FOR THIS WORK (SEE REVERSE).

PERMIT EXPIRES: _____

Replace Exterior Lighting on Buildings
VAMC LD, Lexington, KY
Project No. 596-12-101

SIGNED: _____

(Individual responsible for
authorizing welding and cutting)

TIME STARTED: _____ COMPLETED: _____

FINAL CHECK-UP

Work areas and all adjacent areas to which sparks and heat might have spread (including floors above and below and on opposite walls) were inspected 30 minutes after the work was completed and were found fire safe.

SIGNED: _____

(Supervisor or Fire Watcher)

Replace Exterior Lighting on Buildings
VAMC LD, Lexington, KY
Project No. 596-12-101

ATTENTION: BEFORE APPROVING ANY CUTTING AND WELDING PERMIT, THE SAFETY OFFICE SHALL INSPECT THE WORK AREA AND CONFIRM THAT PRECAUTIONS HAVE BEEN TAKEN TO PREVENT FIRE IN ACCORDANCE WITH NFPA 51 B.

PRECAUTIONS

Sprinklers in service

Cutting and welding equipment in good repair

WITHIN 35 FT. OF WORK

Floors swept clean of combustibles

Combustible floors wet-down, covered with damp sand, metal or other shields

No combustible material or flammable liquids

Combustibles and flammable liquids protected with covers, guards or metal shields

All wall and floor openings covered

Covers suspended beneath work to collect sparks

WORK ON WALLS OR CEILINGS

Construction noncombustible and without combustible covering

Combustibles moved away from opposite side of wall

WORK ON ENCLOSED EQUIPMENT

(Tanks, containers, ducts dust collectors, etc.)

Equipment cleaned of all combustibles

Replace Exterior Lighting on Buildings
VAMC LD, Lexington, KY
Project No. 596-12-101

Containers purged of flammable vapors

FIRE WATCH

(To be provided during and 30 minutes after operation)

Supplied with extinguisher and small hose

Trained in use of equipment and in sounding fire alarm

FINAL CHECK-UP

(To be made 30 minutes after completion of any operation unless fire watch is provided)

SIGNED: _____

(Supervisor)

Replace Exterior Lighting on Buildings
VAMC LD, Lexington, KY
Project No. 596-12-101

ATTACHMENT B - FIRE AND SMOKE BARRIER PERMIT

Replace Exterior Lighting on Buildings
VAMC LD, Lexington, KY
Project No. 596-12-101

ATTACHMENT A
VA MEDICAL CENTER
LEXINGTON, KENTUCKY

MEMORANDUM NO. 138-35
APRIL 8, 2009

FIRE AND SMOKE BARRIER PENETRATION PERMIT

Project Name/Contract #:	Issue Date:
Approved By (Engineering Representative):	Permit issued to:
Describe penetration activities and reasons:	
Barrier I:	
Location of barrier(s) to be penetrated (building number, wing, floor, room number) (Attach sketch if applicable)(Reference drawing when possible) (Use separate sheet if required)	
Location of ceiling tile(s) to be removed (building number, wing, floor, room number) (Attach sketch if applicable) (Use separate sheet if required)	
Describe methods, materials, and techniques to seal penetrations. (Use separate sheet if required)	

Replace Exterior Lighting on Buildings
VAMC LD, Lexington, KY
Project No. 596-12-101

Barrier II: (use if more than one in project)			
Location of barrier(s) to be penetrated (building number, wing, floor, room number) (Attach sketch if applicable)(Reference drawing when possible) (Use separate sheet if required)			
Location of ceiling tile(s) to be removed (building number, wing, floor, room number) (Attach sketch if applicable) (Use separate sheet if required)			
Describe methods, materials, and techniques to seal penetrations. (Use separate sheet if required)			
Answer all three before signing permit. (Circle selection)			
1. Did the responsible person obtain prints from Engineering detailing hourly rated walls and identified scope of the fire stop work?	Y	N	N/A
2. Is manufacturer's product (fire sealant) application guide containing UL/FM listed fire stop systems available and approved?	Y	N	N/A
3. Has the responsible person prepared an itemized schedule of fire/smoke walls to be penetrated?	Y	N	N/A
Final Inspection by Department/Contractor Representative:		Safety/Facilities Representative:	
Date:		Date:	

INSTRUCTIONS:

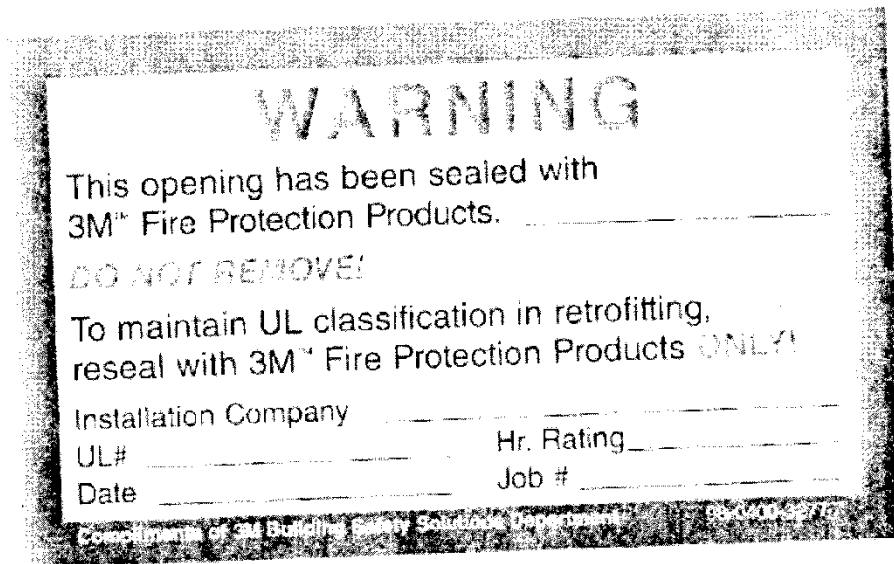
1. Maintain a copy of this permit at the work area at all times.
2. Promptly repair penetrations in an approved manner. Contact Facilities Management/COTR if there are any questions regarding the repairs.
3. Notify Facilities Management/COTR/Safety when repairs are completed to schedule final inspection.

Replace Exterior Lighting on Buildings
VAMC LD, Lexington, KY
Project No. 596-12-101

ATTACHMENT B
VA MEDICAL CENTER
LEXINGTON, KENTUCKY

MEMORANDUM NO. 138-35
APRIL 8, 2009

The following sample sticker must be used to mark date, type and permit number for the sealed penetration.



1. If another equivalent, approved brand was used, cross out 3M and print the product name on the provided line.
2. Installation company. Enter the name of the contractor performing the work.
3. UL#. Enter the UL# of the product.
4. Hr Rating. Enter the rating of the material.
5. Date. Date the penetration was sealed.
6. Job #. Enter the permit number that allowed this work to be completed.

Replace Exterior Lighting on Buildings
VAMC LD, Lexington, KY
Project No. 596-12-101

ATTACHMENT C - INTERIM LIFE SAFETY MEASURE (ILSM) FORMS

ATTACHMENT A
INTERIM LIFE SAFETY REQUIREMENTS

PROJECT/ACTIVITY TITLE _____
PROJECT NO. (if any) _____
DATE/TIME START _____ DATE/TIME END _____
SCOPE OF WORK _____

Utilities to be taken out of service water ☐ electricity ☐ HVAC ☐ None ☐. If a utility is checked, a Utility outage permit must be completed and attached to this ISLM before the ISLM can be implemented.

Complete the ISLM Assessment matrix and circle those items required or considered and required for this project. Matrix attached ☐

Complete the ISLM Inspection Checklist at Attachment C based on the items identified in the matrix. The supervisor of the work site is responsible for daily inspection of the interim measures. The COTR or Asst Chief Engineer will make periodic inspections to ensure compliance with the ISLM requirements.

Describe specific actions here: _____

Notifications:

<input type="checkbox"/> Electrical shop	POC
<input type="checkbox"/> Plumbing shop	POC
<input type="checkbox"/> Grounds/Transportation	POC
<input type="checkbox"/> HVAC shop	POC
<input type="checkbox"/> Safety office	POC
<input type="checkbox"/> Security	POC
<input type="checkbox"/> Fire Department	POC
<input type="checkbox"/> POC who will conduct inspections	POC
<input type="checkbox"/> Chief Engineering	POC
<input type="checkbox"/> Director's Office (as required)	POC

_____ Project Manager	_____ Date	_____ Safety Manager	_____ Date
--------------------------	---------------	-------------------------	---------------

NOTE: Matrix and inspection sheets will be attached to the project documentation for record.

ATTACHMENT B

ILSM Inspection Checklist										
<p><i>Enter the dates across the top squares; inspect the items 'X-ed' in the left column and initial for that item in the date column. This checklist must be turned into the COTR at the end of the ILSM period or end of the week - whichever comes first or to Safety Office if internal activity. COTR/Safety additional may be entered after the last standard measure.</i></p>										
CONSTRUCTION SUPERVISOR Requirement:										
Required (X)	Measure to inspect and date inspected. Initial each required item below the date									
	Notify fire department of outage									
	Ensure free and unobstructed exits									
	Modify EXIT signage to meet modification/identify alternate									
	Ensure Access for Emergency Responders									
	Construct Non-Combustible Temporary Partitions									
	Prohibit Smoking									
	Control combustible loads (storage, housekeeping, debris and waste)									
	Increase Hazard Surveillance/Inspections									
	Implement Fire Watch with communication and extra extinguisher									
	Inspect exits in affected areas daily									
	Provide Additional Education to all Personnel									
	Provide additional fire extinguishers									
	Inspect, test and document temporary systems monthly									
VAMC Requirement: COTR/Safety will confirm completion of these measures.										
	Provide equivalent alarm/notification to impacted staff									
	Conduct 2 fire drills per shift in LOCAL areas									
	Conduct 2 fire drills per shift in all areas									
	Train staff to Compensate for Deficiencies									
Comments:										

Interim measure clarification

☐ Ensuring free and unobstructed exits. Staff receives additional information/communication when alternative exits are designated. Buildings or areas under construction must maintain escape routes for construction workers at all times, and the means of exiting construction areas are inspected daily.

☐ Ensuring free and unobstructed access to emergency services and for fire, police, and other emergency forces

☐ Ensuring that fire alarm, detection, and suppression systems are in good working order. A temporary but equivalent system must be provided when any fire system is impaired. Temporary systems must be inspected and tested monthly.¹

¹ = NFPA 101 fire watch requirements can be found at NFPA 101, 2006 Edition, 9.6.1.6

☐ * Ensuring that temporary construction partitions are smoke-tight and built of noncombustible or limited combustible materials that will not contribute to the development or spread of fire

☐ ** Providing additional fire-fighting equipment and training staff in its use

☐ * Prohibiting smoking throughout the hospital's buildings and in and near construction areas

☐ * Developing and enforcing storage, housekeeping, and debris-removal practices that reduce the building's flammable and combustible fire load to the lowest feasible level

☐ ** Conducting a minimum of two fire drills per shift per quarter

☐ ** Increasing surveillance of buildings, grounds, and equipment, with special attention to excavations, construction areas, construction storage, and field offices

☐ ** Training staff to compensate for impaired structural or compartmentalization features of fire safety

☐ ** Conducting hospital wide safety education programs to promote awareness of fire safety building deficiencies, construction hazards, and ILSMs

☐ * Notifications/coordination completed with (check as appropriate). POC is point of contact to whom notification or coordination was made:

ILSM DECISION MATRIX																	
This matrix should be used to assess appropriate interim measures to implement for activities that will reduce a life safety component(s) for four or more hours. Recommend the matrix be attached to each ILSM with the R or C circled to show evaluation and requirements. The results will also be used to identify the items to be inspected each day the life																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	Notify fire department of outage	Ensure free and unobstructed exits	Modify EXIT signage to meet modification/identif	Ensure Access for Emergency Responders	Construct Non-Combustible Temporary	Prohibit Smoking	Control combustible loads (storage, housekeeping,	Conduct 2 fire drills per shift in LOCAL areas	Conduct 2 fire drills per shift in all areas	Increase Hazard Surveillance/inspections	Train staff to Compensate for Deficiencies	Provide Additional Education to all Personnel	Implement Fire Watch with communication	Inspect exits in affected areas	Provide equivalent alarm/notification to impacted staff	Provide additional fire extinguishers	Inspect, test and document temporary systems
CODE DEFICIENCIES																	
1. Exit stair discharges improperly			R			R		R	C		R	C		C			
2. Smoke barrier is deficient						R		R		R	R					R	
3. Exit path reduces protection level			C			R				C				R			
4. Vertical opening improperly protected						R											
5. Building construction type is nonconforming						R	R		R			R				R	
6. Hazardous room is improperly protected (laundry, linen storage, flammable storage, boiler, kitchen, etc)						R			R							R	
7. Corridor wall is deficient						R	R	R		R	R						
8. Exit is closed or impaired (any portion from work area to exterior assembly)						R	R	R	C	R	R	R		C		R	
CONSTRUCTION HAZARD																	
9. Significantly modifying a smoke barrier					R	R	R	R	C	R	C	C					
10. Constructing a building addition to an existing building	C	R	R	R	R	R		R	C	R		R		C			
11. Significantly renovating an occupied floor.		R			R	R	R	R		C		C		C		R	
LIFE SAFETY SYSTEM DISRUPTIONS																	
11. Fire alarm out of service						R					R	C			R		C
12. Fire detection out of service						R	R				R	C	R		C	R	C
13. Fire suppression out of service	R					R	R			R	R	C	R			R	C

Yellow indicates a VAMC requirement.

R = required actions

C = these actions must be considered. Documentation of the negative should be on the or project documentation.

Replace Exterior Lighting on Buildings
VAMC LD, Lexington, KY
Project No. 596-12-101

ATTACHMENT D - UTILITY SYSTEMS SERVICE/OUTAGE NOTIFICATION FORM

Replace Exterior Lighting on Buildings

VAMC LD, Lexington, KY

Project No. 596-12-101

DEPARTMENT OF VETERANS AFFAIRS Medical Center 1101 Veterans Drive Lexington, KY 40502-2236	Utility Systems Service/Outage Notification	Type of Service: <u>(circle)</u> <u>Shutdown / Service Notice</u>
---	--	---

To: **VAMC Operations** Date of Request: _____
 From: _____ Project: _____

Contractor performing work: _____

VA COTR: _____

System/Utility Involved _____

VAMC Division (circle) _____ **Leestown** or **Cooper** _____

Location of work & area/room(s) affected:

Contingency plan for utility failure:

Requested system service date(s): (10 Day Notice Required) Start: _____ Finish: _____	Approved service date(s): Start: _____ Finish: _____
Requested time of system work: _____	Approved time of system work: _____
Requested time system back on line: _____	Approved time system back on line: _____

VAMC Projects Approval: _____ Date: _____

VAMC Maint. Supervisor Approval : _____ Date: _____

VAMC WO # _____

VAMC Contact During Work Activity: _____

Contractor Contact –Onsite _____ Phone: _____

*Life safety system affected (circle one): yes no

*If system work affects Life Safety System(s), the following must sign this form and an ILSM assessment must be completed and attached.

Facility Manager of Operations approval: _____

Chief, Engineering Service approval: _____

Replace Exterior Lighting on Buildings
VAMC LD, Lexington, KY
Project No. 596-12-101

Lexington VAMC Form 1
Building Alteration, Construction, Project, Maintenance Activity Risk Assessment and Permit

Activity Title: _____

Activity #: _____

Specifics of Activity to be done: _____

Location BLDG/FLR/RM#: _____

Activity Start Date: _____

PROJ/MAINT. COOR (PRINT): _____

PRE-CONSTRUCTION RISK ASSESSMENT:	YES	N/A
Off tour activity will be necessary	<input type="checkbox"/>	<input type="checkbox"/>
The Following Shops/Sections Will Be Involved In This Project: <div style="display: flex; flex-wrap: wrap; padding: 5px;"> <div style="margin-right: 10px;"><input type="checkbox"/> EMS</div> <div style="margin-right: 10px;"><input type="checkbox"/> IT</div> <div style="margin-right: 10px;"><input type="checkbox"/> UTIL</div> <div style="margin-right: 10px;"><input type="checkbox"/> Area Maintenance.</div> <div style="margin-right: 10px;"><input type="checkbox"/> Grounds</div> <div style="margin-right: 10px;"><input type="checkbox"/> Locksmith</div> <div style="margin-right: 10px;"><input type="checkbox"/> EOC</div> <div style="margin-right: 10px;"><input type="checkbox"/> Clinical Engineer</div> <div style="margin-right: 10px;"><input type="checkbox"/> Infection Control</div> <div style="margin-right: 10px;"><input type="checkbox"/> Security</div> </div>		

Step 1: Determining Activity Type(s)

Using the following table, identify the type of activity

INFECTION CONTROL ASSESSMENT- Activity Types	YES	NO
INSPECTION AND NON-INVASIVE ACTIVITIES (TYPE A) <ul style="list-style-type: none"> Remove ceiling tiles for visual inspection or replacement limited to 2 tiles per 20 square feet Painting (but not sanding) Wall covering, electrical trim work, minor plumbing, access to chase spaces and activities that do not generate dust or require cutting of walls or access to ceilings other than for visual inspection. 	<input type="checkbox"/>	<input type="checkbox"/>
SMALL SCALE, SHORT DURATION ACTIVITIES WHICH CREATE MINIMAL DUST (TYPE B) <ul style="list-style-type: none"> Small scale - Sanding of wall for painting or wall covering. Installation or removal of wiring or telephone and computer cable. Small scale construction/demolition that can be contained within the room where the activity is occurring. Cutting of walls or ceiling where dust migration can be controlled 	<input type="checkbox"/>	<input type="checkbox"/>
WORK THAT GENERATES A MODERATE TO HIGH LEVEL OF DUST (TYPE C) <ul style="list-style-type: none"> Medium to large scale demolition/construction that will involve multiple rooms and the activity cannot be contained in the room where it is occurring Removal of any fixed building components or assemblies Large to Medium scale - removal of floor coverings, ceiling tiles and casework. Major duct work or electrical work above ceiling Major cabling activities 	<input type="checkbox"/>	<input type="checkbox"/>
MAJOR DEMOLITION AND CONSTRUCTION PROJECTS (TYPE D) <ul style="list-style-type: none"> Major construction/demolition/excavation that will involve large areas of the medical center. Requires heavy demolition or removal of a complete system. New Construction connecting to existing buildings. 	<input type="checkbox"/>	<input type="checkbox"/>

Replace Exterior Lighting on Buildings
VAMC LD, Lexington, KY
Project No. 596-12-101

ATTACHMENT E - INFECTION CONTROL RISK ASSESSMENT FORMS

Step 2: Determining Risk Group

Using the following table, identify the patient risk area(s) that will be affected. If more than one risk area will be affected, select the higher risk area.

INFECTION CONTROL ASSESSMENT- Risk Areas			YES	NO
Will Affect One Or More Of The Following Areas (LOW RISK AREA):				
<ul style="list-style-type: none"> • Communication Center • Compartment/Switch rooms • Engineer/mechanical 	<ul style="list-style-type: none"> • Equipment rooms • Library, Auditorium • Locker • Morgue 	<ul style="list-style-type: none"> • Office areas • On-Call Sleeping Room • Other similar spaces 	<input type="checkbox"/>	<input type="checkbox"/>
Will Affect One Or More Of The Following Areas (MODERATE RISK AREA):				
<ul style="list-style-type: none"> • Canteen • Cardiology • Chapel • Echocardiography • Endoscopy 	<ul style="list-style-type: none"> • Kitchen • Labs other than micro • Lobbies • Nuclear Medicine • Outpatient Clinics 	<ul style="list-style-type: none"> • Physical Therapy • Radiology /MRI • Respiratory Therapy • Other similar spaces 	<input type="checkbox"/>	<input type="checkbox"/>
Will Affect One Or More Of The Following Areas (HIGH RISK AREA)				
<ul style="list-style-type: none"> • Any area caring for immunocompromised patients • Cardiac Cath Lab • Coronary Care Unit • Emergency Room • Intensive Care Units 	<ul style="list-style-type: none"> • Microbiology Labs • Negative pressure isolation rooms • Operating rooms • Outpatient Surgery • Pharmacy 	<ul style="list-style-type: none"> • Post Anesthesia Care Unit • Surgical Units • Psych Inpatient/PKU • Medical Inpatient Unit • Surgical Recovery • Other similar spaces 	<input type="checkbox"/>	<input type="checkbox"/>

Step 3: Determining Class of Activity

On the table below, circle the Activity Type (A, B, C or D) and the Risk Level (Low to High) and plot where they intersect to find the Infection Control Requirements (Class I, II, III or IV). When the Class is identified, go to the next page for the requirements. **Permits are not required for Class I or II projects, but Infection Control must be consulted for Class III or IV activities.**

Circle highest from Step 1 & 2	From step 1: Activity Type(s)			
From step 2: Risk Level	Type A	Type B	Type C	Type D
LOW Risk Area	Class I	Class II	Class II	Class IV
MODERATE Risk Area	Class I	Class II	Class III	Class IV
HIGH Risk Area	Class II	Class III	Class III	Class IV

Step 4: Determining Risk and Class of Areas Surrounding Project

Identify the areas surrounding the project area. Using the tables above, assess the risk group(s) and potential impact of the activity on each area surrounding the project. Precautions will need to be taken as specified in the requirements.

Unit Below	Unit Above	Lateral	Lateral	Behind	Front
Activity Type:	Activity Type:	Activity Type:	Activity Type:	Activity Type:	Activity Type:
Risk Group:	Risk Group:	Risk Group:	Risk Group:	Risk Group:	Risk Group:
Class:	Class:	Class:	Class:	Class:	Class:

Requirements

(Failure to comply with these requirements will result in stoppage of all work until compliant)

CLASS OF PROJECT: <input type="checkbox"/> I <input type="checkbox"/> II <input type="checkbox"/> III <input type="checkbox"/> IV	
DURING CLASS I CONSTRUCTION PROJECTS:	UPON COMPLETION OF PROJECT:
<ul style="list-style-type: none"> • Dress: Appropriate for area (i.e. shoe covers, etc., in OR). • Ventilation: Execute work by methods to minimize raising dust. • Barriers: Use care removing ceiling tiles, clean up disturbed dust immediately by HEPA (defined as one capturing 99.97% of particles ≥ 0.3 microns in size) vacuuming and/or wet mopping. Immediately replace any ceiling tiles displaced for visual inspection or replacement. No dust tracks outside work zone. • Debris: Remove from work site in a closed/sealed container 	<ul style="list-style-type: none"> • Damp-wipe tools when removed from the work site • Clean work area upon completion of task.
DURING CLASS II CONSTRUCTION PROJECTS:	UPON COMPLETION OF PROJECT:
<p>NOTE: Include activities in Class I above</p> <ul style="list-style-type: none"> • Traffic: Route patient/visitor/staff traffic away from project/activity. • Ventilation: Provide means to prevent airborne dust from dispersing into atmosphere. • Barriers: Water mist work surfaces to control dust while cutting. Seal unused doors with duct tape. Place dust mat at entrance & exit of work area 	<ul style="list-style-type: none"> • Wipe work surface with disinfectant. • Contain construction waste before transport in tightly covered containers. • Wet mop and /or vacuum with HEPA filtered vacuum before leaving work area.
DURING CLASS III CONSTRUCTION PROJECTS:	UPON COMPLETION OF PROJECT
<p>NOTE: Include activities in Class I and II above</p> <ul style="list-style-type: none"> • Traffic: Post signs identifying alternate routes and that construction project are underway. Workers should not walk in hallways or patient-care areas with dust-covered work clothes. • Ventilation: Remove or isolate HVAC system in area where work is being done to prevent contamination of duct system. Block/seal HVAC supply air sources (ducts, grilles, pipes, conduits, and wall/ceiling/floor penetrations). Exhaust air to the outside if possible. If re-circulated air from the construction zone is unavoidable, use a pre-filter and a HEPA filter before the air returns to the HVAC system. When vibration-related is being done that may dislodge dust in the ventilation system, or when modifications are made to duct work serving occupied spaces, install filters on the supply air grilles temporarily. Maintain negative pressure in work site relative to patient areas. Use HEPA-filtered fans if needed (monitor need to change or clean filters during construction). • Barriers: Must be provided to contain dust in the negative pressure work site. Complete all dust barriers i.e. sheetrock, plywood, plastic, to seal area from non work area or implement control cube method(cart with plastic covering and sealed connection to work site with HEPA vacuum for vacuuming prior to exit) before construction begins. Examples include isolating area by closing/sealing existing doors/windows, or erecting an airtight 4- to 6-mil plastic or dry wall barrier that extends from floor to upper deck (or dropped ceiling). Seams in plastic sheeting must be sealed with duct tape and the barrier taped securely to the ceiling and floor. A plastic entrance must have a 2-foot flap. Maintain negative air pressure within work site utilizing HEPA equipped air filtration units. Doors in a dry wall barrier must have gaskets to prevent exhaust of dust. Place tack mats at entrance and wet mop area outside of barrier if dust is tracked outside work site. Construct anteroom and require all personnel, equipment, materials, and debris containers to pass through this room when entering or exiting the work site. Water mains, branch mains, risers, and branches to a group of fixtures have stop valves. Ceiling access panels must be closed when unattended. 	<ul style="list-style-type: none"> • Do not remove barriers from work area until project is inspected by COTR and Infection Control, and thoroughly cleaned. • Vacuum work area with HEPA filtered vacuums. • Wet mop area with hospital disinfectant at completion of project or at the end of the day for jobs lasting more than one day. • Remove barrier materials carefully to minimize spreading of dirt debris associated with construction and clean residual dust. • Remove isolation of HVAC system and HEPA filters in areas where work is being performed. • Vent system cleaned after completion of construction. • Flush the main water system to clear dust-contaminated lines. • Contact Infection Control for inspection prior to patient occupation. • Wet ceiling tiles: if porous, remove and replace; if nonporous, remove, clean with dilute hypochlorite (10% household bleach) and dry before replacement.

Replace Exterior Lighting on Buildings
VAMC LD, Lexington, KY
Project No. 596-12-101

DURING CLASS III CONSTRUCTION PROJECTS (continued):	UPON COMPLETION OF PROJECT
<ul style="list-style-type: none"> • Barriers: Elevator shafts, dumb waiters, and stair wells within the field of construction must have proper barriers installed and air leaks sealed. Mist work surfaces to control dust when drilling or cutting, or HEPA-filtered vacuum cleaner concurrently with drilling work. Place dust mat at entrance and exit of work area. • Debris: Debris is to be removed by specified route only. Transport debris during low patient activity periods if possible (nights and weekends). Contain construction waste before transport in tightly covered containers Cover transport receptacles or carts. Tape covering unless solid lid. Mist debris and cover and damp wipe (including wheels and casters) containers used to transport debris. Consider use of chutes to the outside for debris removal. For personnel transporting debris, cover gown or equivalent and shoe covers required if dust cannot be removed from clothing with HEPA vacuum. 	
DURING CLASS IV CONSTRUCTION PROJECTS:	UPON COMPLETION OF PROJECT:
<p>NOTE: Include activities in Class I, II and III above</p> <ul style="list-style-type: none"> • Ventilation: Isolate HVAC system in area where work is being done to prevent contamination of duct system. • Barriers: Complete all critical barriers i.e. sheetrock, plywood, plastic, to seal area from non work area or implement control cube method(cart with plastic covering and sealed connection to work site with HEPA vacuum for vacuuming prior to exit) before construction begins. Maintain negative air pressure within work site utilizing HEPA equipped air filtration units. Seal holes, pipes, conduits, and punctures appropriately. Construct anteroom and requires all personnel to pass through this room so they can be vacuumed using a HEPA vacuum cleaner before leaving work site or they can wear cloth or paper coveralls that are removed each time they leave the work site. Do not remove barriers from work area until project is inspected by COTR and thoroughly cleaned. 	<ul style="list-style-type: none"> • Remove barriers material carefully to minimize spreading of dirt and debris associated with construction. • Contain construction waste before transport in tightly covered containers. • Cover transport receptacles or carts. Tapes covering unless solid lid. • Vacuum work area with disinfectant. • Wet mop area with disinfectant • Remove isolation of HVAC system in areas where work is being performed

Additional Requirements: _____

WHEN INFECTION CONTROL MEASURES ARE IN PLACE IC STAFF HAS CONDUCTED CONTRACTOR BRIEFINGS & TRAINING	N/A	DATE & INITIALS
Met with Services/Sections surrounding construction site to inform them of impact/precautions to be taken & to instruct them in Basic I/C requirements (see attached).	<input type="checkbox"/>	
Met with the Construction Manager, Construction Crews, and Sub-Contractors to inform them of impact/precautions to be taken & to instruct them in Basic I/C requirements.	<input type="checkbox"/>	
Informed the Project Coordinator That Barriers Are Not To Be Removed From Work Area Until Completed Project Is Inspected By The EOC And Infection Control Staff And Thoroughly Cleaned By The Environmental Management Service.	<input type="checkbox"/>	

Signature of Project Engineer or Supervisor

Date

Signature of Chief Engineer

Date

Signature of Infection Control

Date

Replace Exterior Lighting on Buildings
VAMC LD, Lexington, KY
Project No. 596-12-101

ATTACHMENT F - AIR PERMIT APPLICATION EXAMPLE

(click on object to open)

Replace Exterior Lighting on Buildings
VAMC LD, Lexington, KY
Project No. 596-12-101



December 7, 2010

Mr. Rick Shewekah
KY Dept. for Environmental Protection
Division for Air Quality
Permit Review Branch
200 Fair Oaks Lane
Frankfort, KY 40601-1134

Subject: Conditional Major Permit Application
VA Med Center – Leestown Division
Lexington (Fayette County), Kentucky

Dear Mr. Shewekah:

Project No. 110-0580

The Lexington Veterans Affairs Medical Center (VA Med Center – Leestown Division) in Lexington (Fayette County), Kentucky, is submitting the attached application package for a minor modification to their Construction Permit No. C-85-216 issued in 1985. The application package includes the necessary DEP7007 forms as well as supporting documentation including figures, calculation tables, and technical/specification information.

If there are any questions regarding this submission, you may contact Richard Archer, VA Med Center Cooper Drive Division GEMS Coordinator at (859) 233-5411 or feel free to contact either of the undersigned at (859) 294-5155. Thank you.

Sincerely,

SHIELD ENVIRONMENTAL ASSOCIATES, INC.

A handwritten signature in blue ink, appearing to read 'Nicole Galavotti'.

Nicole R. Galavotti, P.E.
Principal/Sr. Environmental Engineer
email: nicole_galavotti@shieldenv.com

A handwritten signature in blue ink, appearing to read 'Nicholas Levitt'.

Nicholas Levitt
Environmental Scientist
email: nick_levitt@shieldenv.com

cc: Mr. Steve Archer, GEMS Coordinator – VA Med Center Cooper Division

Attachments



Lexington
845 Floyd Drive
Lexington, KY 40502
Telephone 859.294.5155
Fax 859.294.5255
www.shieldenv.com

Lexington, KY

Replace Exterior Lighting on Buildings
VAMC LD, Lexington, KY
Project No. 596-12-101

----- END -----

SECTION 01 32 16.15
PROJECT SCHEDULES

PART 1- GENERAL

1.1 DESCRIPTION:

- A. The Contractor shall develop a Critical Path Method (CPM) plan and schedule demonstrating fulfillment of the contract requirements (Project Schedule), and shall keep the Project Schedule up-to-date in accordance with the requirements of this section and shall utilize the plan for scheduling, coordinating and monitoring work under this contract (including all activities of subcontractors, equipment vendors and suppliers). Conventional Critical Path Method (CPM) technique shall be utilized to satisfy both time and cost applications.

1.2 CONTRACTOR'S REPRESENTATIVE:

- A. The Contractor shall designate an authorized representative responsible for the Project Schedule including preparation, review and progress reporting with and to the Contracting Officer's Representative (COTR).
- B. The Contractor's representative shall have direct project control and complete authority to act on behalf of the Contractor in fulfilling the requirements of this specification section.
- C. The Contractor's representative shall have the option of developing the project schedule within their organization or to engage the services of an outside consultant. If an outside scheduling consultant is utilized, Section 1.3 of this specification will apply.

1.3 COMPUTER PRODUCED SCHEDULES

- A. The contractor shall provide monthly, to the Department of Veterans Affairs (VA), all computer-produced time/cost schedules and reports generated from monthly project updates. This monthly computer service will include: three copies of up to five different reports (inclusive of all pages) available within the user defined reports of the scheduling software approved by the Contracting Officer; a hard copy listing of all project schedule changes, and associated data, made at the update and an electronic file of this data; and the resulting monthly updated schedule in PDM format. These must be submitted with and substantively support the contractor's monthly payment request and the signed look ahead report. The COTR shall identify the five different report formats that the contractor shall provide.
- B. The contractor shall be responsible for the correctness and timeliness of the computer-produced reports. The Contractor shall also be responsible for the accurate and timely submittal of the updated project schedule

and all CPM data necessary to produce the computer reports and payment request that is specified.

- C. The VA will report errors in computer-produced reports to the Contractor's representative within ten calendar days from receipt of reports. The Contractor shall reprocess the computer-produced reports when requested by the Contracting Officer's representative, to correct errors which affect the payment and schedule for the project.

1.4 THE COMPLETE PROJECT SCHEDULE SUBMITTAL

- A. Within 20 calendar days after receipt of Notice to Proceed, the Contractor shall submit for the Contracting Officer's review; three blue line copies of the interim schedule on sheets of paper 765 x 1070 mm (30 x 42 inches) and an electronic file in the previously approved CPM schedule program. The submittal shall also include three copies of a computer-produced activity/event ID schedule showing project duration; phase completion dates; and other data, including event cost. Each activity/event on the computer-produced schedule shall contain as a minimum, but not limited to, activity/event ID, activity/event description, duration, budget amount, early start date, early finish date, late start date, late finish date and total float. Work activity/event relationships shall be restricted to finish-to-start or start-to-start without lead or lag constraints. Activity/event date constraints, not required by the contract, will not be accepted unless submitted to and approved by the Contracting Officer. The contractor shall make a separate written detailed request to the Contracting Officer identifying these date constraints and secure the Contracting Officer's written approval before incorporating them into the network diagram. The Contracting Officer's separate approval of the Project Schedule shall not excuse the contractor of this requirement. Logic events (non-work) will be permitted where necessary to reflect proper logic among work events, but must have zero duration. The complete working schedule shall reflect the Contractor's approach to scheduling the complete project. **The final Project Schedule in its original form shall contain no contract changes or delays which may have been incurred during the final network diagram development period and shall reflect the entire contract duration as defined in the bid documents.** These changes/delays shall be entered at the first update after the final Project Schedule has been approved. The Contractor should provide their requests for time and supporting time extension analysis for contract time as a result of contract changes/delays, after this update, and in accordance with Article, ADJUSTMENT OF CONTRACT COMPLETION.

- D. Within 30 calendar days after receipt of the complete project interim Project Schedule and the complete final Project Schedule, the Contracting Officer or his representative, will do one or both of the following:
1. Notify the Contractor concerning his actions, opinions, and objections.
 2. A meeting with the Contractor at or near the job site for joint review, correction or adjustment of the proposed plan will be scheduled if required. Within 14 calendar days after the joint review, the Contractor shall revise and shall submit three blue line copies of the revised Project Schedule, three copies of the revised computer-produced activity/event ID schedule and a revised electronic file as specified by the Contracting Officer. The revised submission will be reviewed by the Contracting Officer and, if found to be as previously agreed upon, will be approved.
- E. The approved baseline schedule and the computer-produced schedule(s) generated there from shall constitute the approved baseline schedule until subsequently revised in accordance with the requirements of this section.

1.5 PROJECT SCHEDULE REQUIREMENTS

- A. Show on the project schedule the sequence of work activities/events required for complete performance of all items of work. The Contractor Shall:
1. Show activities/events as:
 - a. Contractor's time required for submittal of shop drawings, templates, fabrication, delivery and similar pre-construction work.
 - b. Contracting Officer's and Architect-Engineer's review and approval of shop drawings, equipment schedules, samples, template, or similar items.
 - c. Interruption of VA Facilities utilities, delivery of Government furnished equipment, and rough-in drawings, project phasing and any other specification requirements.
 - d. Test pieces of equipment, maintenance and operation manuals, instructions and preventive maintenance tasks.
 - e. VA inspection and acceptance activity/event with a minimum duration of five work days at the end of each phase and immediately preceding any VA move activity/event required by the contract phasing for that phase.

2. Show not only the activities/events for actual construction work for each trade category of the project, but also trade relationships to indicate the movement of trades from one area, floor, or building, to another area, floor, or building, for at least five trades who are performing major work under this contract.
 3. Break up the work into activities/events of a duration no longer than 20 work days each or one reporting period, except as to non-construction activities/events (i.e., procurement of materials, delivery of equipment, concrete and asphalt curing) and any other activities/events for which the COTR may approve the showing of a longer duration. The duration for VA approval of any required submittal, shop drawing, or other submittals will not be less than 20 work days.
 4. Describe work activities/events clearly, so the work is readily identifiable for assessment of completion. Activities/events labeled "start," "continue," or "completion," are not specific and will not be allowed. Lead and lag time activities will not be acceptable.
 5. The schedule shall be generally numbered in such a way to reflect either discipline, phase or location of the work.
- B. The Contractor shall submit the following supporting data in addition to the project schedule:
1. The appropriate project calendar including working days and holidays.
 2. The planned number of shifts per day.
 3. The number of hours per shift.
- Failure of the Contractor to include this data shall delay the review of the submittal until the Contracting Officer is in receipt of the missing data.
- C. To the extent that the Project Schedule or any revised Project Schedule shows anything not jointly agreed upon, it shall not be deemed to have been approved by the COTR. Failure to include any element of work required for the performance of this contract shall not excuse the Contractor from completing all work required within any applicable completion date of each phase regardless of the COTR's approval of the Project Schedule.
- D. Compact Disk Requirements and CPM Activity/Event Record Specifications: Submit to the VA an electronic file(s) containing one file of the data required to produce a schedule, reflecting all the activities/events of the complete project schedule being submitted.

1.7 PAYMENT TO THE CONTRACTOR:

- A. Monthly, the contractor shall submit the AIA application and certificate for payment documents G702 & G703 reflecting updated schedule activities and cost data in accordance with the provisions of the following Article, PAYMENT AND PROGRESS REPORTING, as the basis upon which progress payments will be made pursuant to Article, FAR 52.232 - 5 (PAYMENT UNDER FIXED-PRICE CONSTRUCTION CONTRACTS) and VAAR 852.236 - 83 (PAYMENT UNDER FIXED-PRICE CONSTRUCTION CONTRACTS). The Contractor shall be entitled to a monthly progress payment upon approval of estimates as determined from the currently approved updated project schedule. Monthly payment requests shall include: a listing of all agreed upon project schedule changes and associated data; and an electronic file (s) of the resulting monthly updated schedule.
- B. Approval of the Contractor's monthly Application for Payment shall be contingent, among other factors, on the submittal of a satisfactory monthly update of the project schedule.

1.8 PAYMENT AND PROGRESS REPORTING

- A. Monthly schedule update meetings will be held on dates mutually agreed to by the COTR and the Contractor. Contractor and their CPM consultant (if applicable) shall attend all monthly schedule update meetings. The Contractor shall accurately update the Project Schedule and all other data required and provide this information to the COTR three work days in advance of the schedule update meeting. Job progress will be reviewed to verify:
1. Actual start and/or finish dates for updated/completed activities/events.
 2. Remaining duration for each activity/event started, or scheduled to start, but not completed.
 3. Logic, time and cost data for change orders, and supplemental agreements that are to be incorporated into the Project Schedule.
 4. Changes in activity/event sequence and/or duration which have been made, pursuant to the provisions of following Article, ADJUSTMENT OF CONTRACT COMPLETION.
 5. Completion percentage for all completed and partially completed activities/events.
 6. Logic and duration revisions required by this section of the specifications.
 7. Activity/event duration and percent complete shall be updated independently.

- B. After completion of the joint review, the contractor shall generate an updated computer-produced calendar-dated schedule and supply the Contracting Officer's representative with reports in accordance with the Article, COMPUTER PRODUCED SCHEDULES, specified.
- C. After completing the monthly schedule update, the contractor's representative or scheduling consultant shall rerun all current period contract change(s) against the prior approved monthly project schedule. The analysis shall only include original workday durations and schedule logic agreed upon by the contractor and COTR for the contract change(s). When there is a disagreement on logic and/or durations, the Contractor shall use the schedule logic and/or durations provided and approved by the COTR. After each rerun update, the resulting electronic project schedule data file shall be appropriately identified and submitted to the VA in accordance to the requirements listed in articles 1.4 and 1.7. This electronic submission is separate from the regular monthly project schedule update requirements and shall be submitted to the COTR within fourteen (14) calendar days of completing the regular schedule update. **Before inserting the contract changes durations, care must be taken to ensure that only the original durations will be used for the analysis, not the reported durations after progress. In addition, once the final network diagram is approved, the contractor must recreate all manual progress payment updates on this approved network diagram and associated reruns for contract changes in each of these update periods as outlined above for regular update periods. This will require detailed record keeping for each of the manual progress payment updates.**
- D. Following approval of the CPM schedule, the VA, the General Contractor, its approved CPM Consultant, RE office representatives, and all subcontractors needed, as determined by the SRE, shall meet to discuss the monthly updated schedule. The main emphasis shall be to address work activities to avoid slippage of project schedule and to identify any necessary actions required to maintain project schedule during the reporting period. The Government representatives and the Contractor should conclude the meeting with a clear understanding of those work and administrative actions necessary to maintain project schedule status during the reporting period. This schedule coordination meeting will occur after each monthly project schedule update meeting utilizing the resulting schedule reports from that schedule update. If the project is behind schedule, discussions should include ways to prevent further slippage as well as ways to improve the project schedule status, when appropriate.

1.9 RESPONSIBILITY FOR COMPLETION

- A. If it becomes apparent from the current revised monthly progress schedule that phasing or contract completion dates will not be met, the Contractor shall execute some or all of the following remedial actions:
 - 1. Increase construction manpower in such quantities and crafts as necessary to eliminate the backlog of work.
 - 2. Increase the number of working hours per shift, shifts per working day, working days per week, the amount of construction equipment, or any combination of the foregoing to eliminate the backlog of work.
 - 3. Reschedule the work in conformance with the specification requirements.
- B. Prior to proceeding with any of the above actions, the Contractor shall notify and obtain approval from the COTR for the proposed schedule changes. If such actions are approved, the representative schedule revisions shall be incorporated by the Contractor into the Project Schedule before the next update, at no additional cost to the Government.

1.10 CHANGES TO THE SCHEDULE

- A. Within 30 calendar days after VA acceptance and approval of any updated project schedule, the Contractor shall submit a revised electronic file (s) and a list of any activity/event changes including predecessors and successors for any of the following reasons:
 - 1. Delay in completion of any activity/event or group of activities/events, which may be involved with contract changes, strikes, unusual weather, and other delays will not relieve the Contractor from the requirements specified unless the conditions are shown on the CPM as the direct cause for delaying the project beyond the acceptable limits.
 - 2. Delays in submittals, or deliveries, or work stoppage are encountered which make rescheduling of the work necessary.
 - 3. The schedule does not represent the actual prosecution and progress of the project.
 - 4. When there is, or has been, a substantial revision to the activity/event costs regardless of the cause for these revisions.
- B. CPM revisions made under this paragraph which affect the previously approved computer-produced schedules for Government furnished equipment, vacating of areas by the VA Facility, contract phase(s) and sub phase(s), utilities furnished by the Government to the Contractor, or any other previously contracted item, shall be furnished in writing to the Contracting Officer for approval.

- C. Contracting Officer's approval for the revised project schedule and all relevant data is contingent upon compliance with all other paragraphs of this section and any other previous agreements by the Contracting Officer or the VA representative.
- D. The cost of revisions to the project schedule resulting from contract changes will be included in the proposal for changes in work as specified in FAR 52.243 - 4 (Changes) and VAAR 852.236 - 88 (Changes - Supplemental), and will be based on the complexity of the revision or contract change, man hours expended in analyzing the change, and the total cost of the change.
- E. The cost of revisions to the Project Schedule not resulting from contract changes is the responsibility of the Contractor.

1.11 ADJUSTMENT OF CONTRACT COMPLETION

- A. The contract completion time will be adjusted only for causes specified in this contract. Request for an extension of the contract completion date by the Contractor shall be supported with a justification, CPM data and supporting evidence as the COTR may deem necessary for determination as to whether or not the Contractor is entitled to an extension of time under the provisions of the contract. Submission of proof based on revised activity/event logic, durations (in work days) and costs is obligatory to any approvals. The schedule must clearly display that the Contractor has used, in full, all the float time available for the work involved in this request. The Contracting Officer's determination as to the total number of days of contract extension will be based upon the current computer-produced calendar-dated schedule for the time period in question and all other relevant information.
- B. Actual delays in activities/events which, according to the computer-produced calendar-dated schedule, do not affect the extended and predicted contract completion dates shown by the critical path in the network, will not be the basis for a change to the contract completion date. The Contracting Officer will within a reasonable time after receipt of such justification and supporting evidence, review the facts and advise the Contractor in writing of the Contracting Officer's decision.
- C. The Contractor shall submit each request for a change in the contract completion date to the Contracting Officer in accordance with the provisions specified under FAR 52.243 - 4 (Changes) and VAAR 852.236 - 88 (Changes - Supplemental). The Contractor shall include, as a part of each change order proposal, a sketch showing all CPM logic revisions, duration (in work days) changes, and cost changes, for work in question

Replace Exterior Lighting on Buildings
VAMC LD, Lexington, KY
Project No. 596-12-101

and its relationship to other activities on the approved network diagram.

- D. All delays due to non-work activities/events such as RFI's, WEATHER, STRIKES, and similar non-work activities/events shall be analyzed on a month by month basis.

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SECTION 01 33 23
SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

- 1-1. Refer to Articles titled SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION (FAR 52.236-21) and, SPECIAL NOTES (VAAR 852.236-91), in GENERAL CONDITIONS.
- 1-2. For the purposes of this contract, samples, certificates, and manufacturers' literature and data shall also be subject to the previously referenced requirements. The following text refers to all items collectively as SUBMITTALS.
- 1-3. Submit for approval, all of the items specifically mentioned under the separate sections of the specification, with information sufficient to evidence full compliance with contract requirements. Materials, fabricated articles and the like to be installed in permanent work shall equal those of approved submittals. After an item has been approved, no change in brand or make will be permitted unless:
 - A. Satisfactory written evidence is presented to, and approved by Contracting Officer, that manufacturer cannot make scheduled delivery of approved item or;
 - B. Item delivered has been rejected and substitution of a suitable item is an urgent necessity or;
 - C. Other conditions become apparent which indicates approval of such substitute item to be in best interest of the Government.
- 1-4. Forward submittals in sufficient time to permit proper consideration and approval action by Government. Time submission to assure adequate lead time for procurement of contract - required items. Delays attributable to untimely and rejected submittals will not serve as a basis for extending contract time for completion.
- 1-5. Submittals will be reviewed for compliance with contract requirements by Architect-Engineer, and action thereon will be taken by COTR on behalf of the Contracting Officer.
- 1-6. Upon receipt of submittals, Architect-Engineer will assign a file number thereto. Contractor, in any subsequent correspondence, shall refer to this file and identification number to expedite replies relative to previously approved or disapproved submittals.
- 1-7. The Government reserves the right to require additional submittals, whether or not particularly mentioned in this contract. If additional submittals beyond those required by the contract are furnished pursuant to request therefor by Contracting Officer, adjustment in contract price

and time will be made in accordance with Articles titled CHANGES (FAR 52.243-4) and CHANGES - SUPPLEMENT (VAAR 852.236-88) of the GENERAL CONDITIONS.

- 1-8. Schedules called for in specifications and shown on shop drawings shall be submitted for use and information of Department of Veterans Affairs and Architect-Engineer. However, the Contractor shall assume responsibility for coordinating and verifying schedules. The Contracting Officer and Architect- Engineer assumes no responsibility for checking schedules or layout drawings for exact sizes, exact numbers and detailed positioning of items.
- 1-9. Submittals must be submitted by Contractor only and shipped prepaid. Contracting Officer assumes no responsibility for checking quantities or exact numbers included in such submittals.
 - A. Submit samples in single units unless otherwise specified. Submit shop drawings, schedules, manufacturers' literature and data, and certificates in quadruplicate, except where a greater number is specified.
 - B. Submittals will receive consideration only when covered by a transmittal letter signed by Contractor. Letter shall be sent via first class mail and shall contain the list of items, name of Medical Center, name of Contractor, contract number, applicable specification paragraph numbers, applicable drawing numbers (and other information required for exact identification of location for each item), manufacturer and brand, ASTM or Federal Specification Number (if any) and such additional information as may be required by specifications for particular item being furnished. In addition, catalogs shall be marked to indicate specific items submitted for approval.
 1. A copy of letter must be enclosed with items, and any items received without identification letter will be considered "unclaimed goods" and held for a limited time only.
 2. Each sample, certificate, manufacturers' literature and data shall be labeled to indicate the name and location of the Medical Center, name of Contractor, manufacturer, brand, contract number and ASTM or Federal Specification Number as applicable and location(s) on project.
 3. Required certificates shall be signed by an authorized representative of manufacturer or supplier of material, and by Contractor.
 - C. If submittal samples have been disapproved, resubmit new samples as soon as possible after notification of disapproval. Such new samples shall be

- marked "Resubmitted Sample" in addition to containing other previously specified information required on label and in transmittal letter.
- D. Approved samples will be kept on file by the COTR at the site until completion of contract, at which time such samples will be delivered to Contractor as Contractor's property. Where noted in technical sections of specifications, approved samples in good condition may be used in their proper locations in contract work. At completion of contract, samples that are not approved will be returned to Contractor only upon request and at Contractor's expense. Such request should be made prior to completion of the contract. Disapproved samples that are not requested for return by Contractor will be discarded after completion of contract.
- E. Submittal drawings (shop, erection or setting drawings) and schedules, required for work of various trades, shall be checked before submission by technically qualified employees of Contractor for accuracy, completeness and compliance with contract requirements. These drawings and schedules shall be stamped and signed by Contractor certifying to such check.
1. For each drawing required, submit one legible photographic paper or vellum reproducible.
 2. Reproducible shall be full size.
 3. Each drawing shall have marked thereon, proper descriptive title, including Medical Center location, project number, manufacturer's number, reference to contract drawing number, detail Section Number, and Specification Section Number.
 4. A space 120 mm by 125 mm (4-3/4 by 5 inches) shall be reserved on each drawing to accommodate approval or disapproval stamp.
 5. Submit drawings, ROLLED WITHIN A MAILING TUBE, fully protected for shipment.
 6. One reproducible print of approved or disapproved shop drawings will be forwarded to Contractor.
 7. When work is directly related and involves more than one trade, shop drawings shall be submitted to Architect-Engineer under one cover.
- 1-9. Samples, shop drawings, test reports, certificates and manufacturers' literature and data, shall be submitted for approval to

(Architect-Engineer)

(A/E P.O. Address)

Replace Exterior Lighting on Buildings
VAMC LD, Lexington, KY
Project No. 596-12-101

(City, State and Zip Code)

1-11. At the time of transmittal to the Architect-Engineer, the Contractor shall also send a copy of the complete submittal directly to the COTR.

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Replace Exterior Lighting on Buildings
VAMC LD, Lexington, KY
Project No. 596-12-101

SECTION 01 42 19
REFERENCE STANDARDS

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies the availability and source of references and standards specified in the project manual under paragraphs APPLICABLE PUBLICATIONS and/or shown on the drawings.

1.2 AVAILABILITY OF SPECIFICATIONS LISTED IN THE GSA INDEX OF FEDERAL SPECIFICATIONS, STANDARDS AND COMMERCIAL ITEM DESCRIPTIONS FPMR PART 101-29 (FAR 52.211-1) (AUG 1998)

- A. The GSA Index of Federal Specifications, Standards and Commercial Item Descriptions, FPMR Part 101-29 and copies of specifications, standards, and commercial item descriptions cited in the solicitation may be obtained for a fee by submitting a request to - GSA Federal Supply Service, Specifications Section, Suite 8100, 470 East L'Enfant Plaza, SW, Washington, DC 20407, Telephone (202) 619-8925, Facsimile (202) 619-8978.
- B. If the General Services Administration, Department of Agriculture, or Department of Veterans Affairs issued this solicitation, a single copy of specifications, standards, and commercial item descriptions cited in this solicitation may be obtained free of charge by submitting a request to the addressee in paragraph (a) of this provision. Additional copies will be issued for a fee.

1.3 AVAILABILITY FOR EXAMINATION OF SPECIFICATIONS NOT LISTED IN THE GSA INDEX OF FEDERAL SPECIFICATIONS, STANDARDS AND COMMERCIAL ITEM DESCRIPTIONS (FAR 52.211-4) (JUN 1988)

The specifications and standards cited in this solicitation can be examined at the following location:

DEPARTMENT OF VETERANS AFFAIRS
Office of Construction & Facilities Management
Facilities Quality Service (00CFM1A)
425 Eye Street N.W, (sixth floor)
Washington, DC 20001
Telephone Numbers: (202) 632-5249 or (202) 632-5178
Between 9:00 AM - 3:00 PM

Replace Exterior Lighting on Buildings
VAMC LD, Lexington, KY
Project No. 596-12-101

1.4 AVAILABILITY OF SPECIFICATIONS NOT LISTED IN THE GSA INDEX OF FEDERAL SPECIFICATIONS, STANDARDS AND COMMERCIAL ITEM DESCRIPTIONS (FAR 52.211-3) (JUN 1988)

The specifications cited in this solicitation may be obtained from the associations or organizations listed below.

AA	Aluminum Association Inc. http://www.aluminum.org
AAMA	American Architectural Manufacturer's Association http://www.aamanet.org
ACGIH	American Conference of Governmental Industrial Hygienists http://www.acgih.org
AGC	Associated General Contractors of America http://www.agc.org
ANSI	American National Standards Institute, Inc. http://www.ansi.org
ASME	American Society of Mechanical Engineers http://www.asme.org
ASTM	American Society for Testing and Materials http://www.astm.org
EEI	Edison Electric Institute http://www.eei.org
EPA	Environmental Protection Agency http://www.epa.gov
ETL	ETL Testing Laboratories, Inc. http://www.etl.com
ICEA	Insulated Cable Engineers Association Inc. http://www.icea.net
IEEE	Institute of Electrical and Electronics Engineers http://www.ieee.org/
IPCEA	Insulated Power Cable Engineers Association

Replace Exterior Lighting on Buildings
VAMC LD, Lexington, KY
Project No. 596-12-101

NBS	National Bureau of Standards See - NIST
NEC	National Electric Code See - NFPA National Fire Protection Association
NEMA	National Electrical Manufacturers Association http://www.nema.org
NFPA	National Fire Protection Association http://www.nfpa.org
NIH	National Institute of Health http://www.nih.gov
NIST	National Institute of Standards and Technology http://www.nist.gov
OSHA	Occupational Safety and Health Administration Department of Labor http://www.osha.gov
UBC	The Uniform Building Code See ICBO
UL	Underwriters' Laboratories Incorporated http://www.ul.com
ULC	Underwriters' Laboratories of Canada http://www.ulc.ca

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SECTION 09 91 00
PAINTING

PART 1-GENERAL

1.1 DESCRIPTION

- A. Section specifies field painting.
- B. Section specifies prime coats which may be applied in shop under other sections.
- C. Painting includes shellacs, stains, varnishes, coatings specified, and striping or markers and identity markings.

1.2 RELATED WORK

- A. Shop prime painting of steel and ferrous metals: Division 26 - ELECTRICAL.

1.3 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
Before work is started, or sample panels are prepared, submit manufacturer's literature, the current Master Painters Institute (MPI) "Approved Product List" indicating brand label, product name and product code as of the date of contract award, will be used to determine compliance with the submittal requirements of this specification. The Contractor may choose to use subsequent MPI "Approved Product List", however, only one list may be used for the entire contract and each coating system is to be from a single manufacturer. All coats on a particular substrate must be from a single manufacturer. No variation from the MPI "Approved Product List" where applicable is acceptable.
- C. Sample Panels:
 - 1. After painters' materials have been approved and before work is started submit sample panels showing each type of finish and color specified.
 - 2. Panels to show color: Composition board, 100 by 250 by 3 mm (4 inch by 10 inch by 1/8 inch).
 - 3. Attach labels to panel stating the following:
 - a. Federal Specification Number or manufacturers name and product number of paints used.
 - b. Product type and color.
 - c. Name of project.
 - 5. Strips showing not less than 50 mm (2 inch) wide strips of undercoats and 100 mm (4 inch) wide strip of finish coat.

Replace Exterior Lighting on Buildings
VAMC LD, Lexington, KY
Project No. 596-12-101

- D. Manufacturers' Certificates indicating compliance with specified requirements:
 - 1. Manufacturer's paint substituted for Federal Specification paints meets or exceeds performance of paint specified.
 - 2. High temperature aluminum paint.
 - 3. Epoxy coating.

1.4 DELIVERY AND STORAGE

- A. Deliver materials to site in manufacturer's sealed container marked to show following:
 - 1. Name of manufacturer.
 - 2. Product type.
 - 3. Batch number.
 - 4. Instructions for use.
 - 5. Safety precautions.
- B. In addition to manufacturer's label, provide a label legibly printed as following:
 - 1. Federal Specification Number, where applicable, and name of material.
 - 2. Surface upon which material is to be applied.
 - 3. If paint or other coating, state coat types; prime, body or finish.
- C. Maintain space for storage, and handling of painting materials and equipment in a neat and orderly condition to prevent spontaneous combustion from occurring or igniting adjacent items.
- D. Store materials at site at least 24 hours before using, at a temperature between 18 and 30 degrees C (65 and 85 degrees F).

1.5 APPLICABLE PUBLICATIONS

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by basic designation only.
- B. American Conference of Governmental Industrial Hygienists (ACGIH):
- C. American Society for Testing and Materials (ASTM):
 - D260-86.....Boiled Linseed Oil
- D. Master Painters Institute (MPI):
 - No. 1-12.....Aluminum Paint (AP)
 - No. 8-12.....Exterior Alkyd, Flat MPI Gloss Level 1 (EO)
 - No. 9-12.....Exterior Alkyd Enamel MPI Gloss Level 6 (EO)
 - No. 18-12.....Organic Zinc Rich Primer
 - No. 22-12.....Aluminum Paint, High Heat (up to 590° - 1100F)
(HR)
 - No. 26-12.....Cementitious Galvanized Metal Primer
 - No. 27-12.....Exterior / Interior Alkyd Floor Enamel, Gloss (FE)

Replace Exterior Lighting on Buildings
VAMC LD, Lexington, KY
Project No. 596-12-101

- No. 31-12.....Polyurethane, Moisture Cured, Clear Gloss (PV)
- No. 36-12.....Knot Sealer
- No. 71-12.....Polyurethane, Moisture Cured, Clear, Flat (PV)
- No. 77-12.....Epoxy Cold Cured, Gloss (EC)
- No. 79-12.....Marine Alkyd Metal Primer
- No. 94-12.....Exterior Alkyd, Semi-Gloss (EO)
- No. 95-12.....Fast Drying Metal Primer
- No. 98-12.....High Build Epoxy Coating
- No. 101-12.....Epoxy Anti-Corrosive Metal Primer
- No. 108-12.....High Build Epoxy Coating, Low Gloss (EC)
- No. 119-12.....Exterior Latex, High Gloss (acrylic) (AE)
- No. 135-12.....Non-Cementitious Galvanized Primer
- H. Steel Structures Painting Council (SSPC):
 - SSPC SP 1-04 (R2004)....Solvent Cleaning
 - SSPC SP 2-04 (R2004)....Hand Tool Cleaning
 - SSPC SP 3-04 (R2004)....Power Tool Cleaning

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aluminum Paint (AP): MPI 1.
- B. Exterior Alkyd, Flat (EO): MPI 8.
- C. Exterior Alkyd Enamel (EO): MPI 9.
- D. Organic Zinc rich Coating (HR): MPI 22.
- E. High Heat Resistant Coating (HR): MPI 22.
- F. Epoxy Cold Cured, Gloss (EC): MPI 77.
- G. Marine Alkyd Metal primer: MPI 79.
- H. Exterior Alkyd, Semi-Gloss (EO): MPI 94.
- I. Fast Drying Metal Primer: MPI 95.
- J. High Build Epoxy Coating: MPI 98.
- K. Epoxy Anti-Corrosive Metal Primer: MPI 101.
- L. High Build Epoxy Marine Coating (EC): MPI 108.
- M. Waterborne Galvanized Primer: MPI 134.

2.2 PAINT PROPERTIES

- A. Use ready-mixed (including colors), except two component epoxies, polyurethanes, polyesters, paints having metallic powders packaged separately and paints requiring specified additives.
- B. Where no requirements are given in the referenced specifications for primers, use primers with pigment and vehicle, compatible with substrate and finish coats specified.

Replace Exterior Lighting on Buildings
VAMC LD, Lexington, KY
Project No. 596-12-101

2.3 REGULATORY REQUIREMENTS/QUALITY ASSURANCE

- A. Paint materials shall conform to the restrictions of the local Environmental and Toxic Control jurisdiction.
 - 1. Volatile Organic Compounds (VOC): VOC content of paint materials shall not exceed 10g/l for interior latex paints/primers and 50g/l for exterior latex paints and primers.
 - 2. Lead-Base Paint:
 - a. Comply with Section 410 of the Lead-Based Paint Poisoning Prevention Act, as amended, and with implementing regulations promulgated by Secretary of Housing and Urban Development.
 - b. Regulations concerning prohibition against use of lead-based paint in federal and federally assisted construction, or rehabilitation of residential structures are set forth in Subpart F, Title 24, Code of Federal Regulations, Department of Housing and Urban Development.
 - c. For lead-paint removal, see Section 02 83 33.13, LEAD-BASED PAINT REMOVAL AND DISPOSAL.
 - 3. Asbestos: Materials shall not contain asbestos.
 - 4. Chromate, Cadmium, Mercury, and Silica: Materials shall not contain zinc-chromate, strontium-chromate, Cadmium, mercury or mercury compounds or free crystalline silica.
 - 5. Human Carcinogens: Materials shall not contain any of the ACGIH-BKLT and ACGHI-DOC confirmed or suspected human carcinogens.
 - 6. Use high performance acrylic paints in place of alkyd paints, where possible.
 - 7. VOC content for solvent-based paints shall not exceed 250g/l and shall not be formulated with more than one percent aromatic hydro carbons by weight.

PART 3 - EXECUTION

3.1 JOB CONDITIONS

- A. Safety: Observe required safety regulations and manufacturer's warning and instructions for storage, handling and application of painting materials.
 - 1. Take necessary precautions to protect personnel and property from hazards due to falls, injuries, toxic fumes, fire, explosion, or other harm.
 - 2. Deposit soiled cleaning rags and waste materials in metal containers approved for that purpose. Dispose of such items off the site at end of each days work.
- B. Atmospheric and Surface Conditions:
 - 1. Do not apply coating when air or substrate conditions are:

Replace Exterior Lighting on Buildings
VAMC LD, Lexington, KY
Project No. 596-12-101

- a. Less than 3 degrees C (5 degrees F) above dew point.
- b. Below 10 degrees C (50 degrees F) or over 35 degrees C (95 degrees F), unless specifically pre-approved by the Contracting Officer and the product manufacturer. Under no circumstances shall application conditions exceed manufacturer recommendations.
2. Maintain interior temperatures until paint dries hard.
3. Do no exterior painting when it is windy and dusty.
4. Do not paint in direct sunlight or on surfaces that the sun will soon warm.
5. Apply only on clean, dry and frost free surfaces except as follows:
 - a. Apply water thinned acrylic paints to damp (not wet) surfaces where allowed by manufacturer's printed instructions.
 - b. Dampened with a fine mist of water on hot dry days concrete and masonry surfaces to which water thinned acrylic and cementitious paints are applied to prevent excessive suction and to cool surface.

3.2 SURFACE PREPARATION

- A. Method of surface preparation is optional, provided results of finish painting produce solid even color and texture specified with no overlays.
- B. General:
 1. Remove items for reinstallation and complete painting of such items and adjacent areas when item or adjacent surface is not accessible or finish is different.
 2. See other sections of specifications for specified surface conditions and prime coat.
 3. Clean surfaces for painting with materials and methods compatible with substrate and specified finish. Remove any residue remaining from cleaning agents used.
- C. Ferrous Metals:
 1. Remove oil, grease, soil, drawing and cutting compounds, flux and other detrimental foreign matter in accordance with SSPC-SP 1 (Solvent Cleaning).
 2. Remove loose mill scale, rust, and paint, by hand or power tool cleaning, as defined in SSPC-SP 2 (Hand Tool Cleaning) and SSPC-SP 3 (Power Tool Cleaning). Exception: where high temperature aluminum paint is used, prepare surface in accordance with paint manufacturer's instructions.
 3. Fill dents, holes and similar voids and depressions in flat exposed surfaces specified to have semi-gloss or gloss finish with TT-F-322D (Filler, Two-Component Type, For Dents, Small Holes and Blow-Holes). Finish flush with adjacent surfaces.

Replace Exterior Lighting on Buildings
VAMC LD, Lexington, KY
Project No. 596-12-101

- a. This includes flat head countersunk screws used for permanent anchors.
- b. Do not fill screws of item intended for removal such as glazing beads.
- 4. Spot prime abraded and damaged areas in shop prime coat which expose bare metal with same type of paint used for prime coat. Feather edge of spot prime to produce smooth finish coat.
- 5. Spot prime abraded and damaged areas which expose bare metal of factory finished items with paint as recommended by manufacturer of item.
- D. Zinc-Coated (Galvanized) Metal, Aluminum, Copper and Copper Alloys
Surfaces Specified Painted:
 - 1. Clean surfaces to remove grease, oil and other deterrents to paint adhesion in accordance with SSPC-SP 1 (Solvent Cleaning).
 - 2. Spot coat abraded and damaged areas of zinc-coating which expose base metal on hot-dip zinc-coated items with MPI 18 (Organic Zinc Rich Coating). Prime or spot prime with MPI 134 (Waterborne Galvanized Primer) or MPI 135 (Non- Cementitious Galvanized Primer) depending on finish coat compatibility.

3.3 PAINT PREPARATION

- A. Thoroughly mix painting materials to ensure uniformity of color, complete dispersion of pigment and uniform composition.
- B. Do not thin unless necessary for application and when finish paint is used for body and prime coats. Use materials and quantities for thinning as specified in manufacturer's printed instructions.
- C. Remove paint skins, then strain paint through commercial paint strainer to remove lumps and other particles.
- D. Mix two component and two part paint and those requiring additives in such a manner as to uniformly blend as specified in manufacturer's printed instructions unless specified otherwise.
- E. For tinting required to produce exact shades specified, use color pigment recommended by the paint manufacturer.

3.4 APPLICATION

- A. Start of surface preparation or painting will be construed as acceptance of the surface as satisfactory for the application of materials.
- B. Unless otherwise specified, apply paint in three coats; prime, body, and finish. When two coats applied to prime coat are the same, first coat applied over primer is body coat and second coat is finish coat.
- C. Apply each coat evenly and cover substrate completely.

Replace Exterior Lighting on Buildings
VAMC LD, Lexington, KY
Project No. 596-12-101

- D. Allow not less than 48 hours between application of succeeding coats, except as allowed by manufacturer's printed instructions, and approved by COTR.
- E. Finish surfaces to show solid even color, free from runs, lumps, brushmarks, laps, holidays, or other defects.
- F. Apply by brush, roller or spray, except as otherwise specified.
- G. Do not spray paint in existing occupied spaces unless approved by COTR, except in spaces sealed from existing occupied spaces.
 - 1. In areas, where paint is applied by spray, mask or enclose with polyethylene, or similar air tight material with edges and seams continuously sealed including items specified in WORK NOT PAINTED, motors, controls, telephone, and electrical equipment, fronts of sterilizes and other recessed equipment and similar prefinished items.

3.5 PRIME PAINTING

- A. After surface preparation prime surfaces before application of body and finish coats, except as otherwise specified.
- B. Spot prime and apply body coat to damaged and abraded painted surfaces before applying succeeding coats.
- C. Additional field applied prime coats over shop or factory applied prime coats are not required except for exterior exposed steel apply an additional prime coat.
- D. Prime rebates for stop and face glazing of wood, and for face glazing of steel.
- E. Metals except boilers, incinerator stacks, and engine exhaust pipes:
 - 1. Steel and iron: MPI 79 (Marine Alkyd Metal Primer). Use MPI 101 (Cold Curing Epoxy Primer) where MPI 108 (High Build Epoxy Marine Coating (EC) finish is specified.
 - 2. Zinc-coated steel and iron: MPI 134 (Waterborne Galvanized Primer).
 - 3. Aluminum scheduled to be painted: MPI 95 (Fast Drying Metal Primer).
 - 4. Terne Metal: MPI 79 (Marine Alkyd Metal Primer).
 - 5. Copper and copper alloys scheduled to be painted: MPI 95 (Fast Drying Metal Primer).
 - 6. Machinery not factory finished: MPI 9 (Exterior Alkyd Enamel (EO)).

3.6 EXTERIOR FINISHES

- A. Steel and Ferrous Metal, Including Tern :
 - 1. Two coats of MPI 8 (Exterior Alkyd, Flat (EO)) MPI 9 (Exterior Alkyd Enamel (EO)) on exposed surfaces, except on surfaces over 94 degrees C (200 degrees F).

3.7 REFINISHING EXISTING PAINTED SURFACES

- A. Clean, patch and repair existing surfaces as specified under surface preparation.
- B. Remove and reinstall items as specified under surface preparation.
- C. Remove existing finishes or apply separation coats to prevent non compatible coatings from having contact.
- D. Patched or Replaced Areas in Surfaces and Components: Apply spot prime and body coats as specified for new work to repaired areas or replaced components.
- E. Refinish areas as specified for new work to match adjoining work unless specified or scheduled otherwise.
- F. Coat knots and pitch streaks showing through old finish with MPI 36 (Knot Sealer) before refinishing.
- G. Sand or dull glossy surfaces prior to painting.
- H. Sand existing coatings to a feather edge so that transition between new and existing finish will not show in finished work.

3.9 PAINT COLOR

- A. Color and gloss of finish coats is specified in Section 09 06 00, SCHEDULE FOR FINISHES.
- B. For additional requirements regarding color see Articles, REFINISHING EXISTING PAINTED SURFACE and MECHANICAL AND ELECTRICAL FIELD PAINTING SCHEDULE.
- C. Coat Colors:
 - 1. Color of priming coat: Lighter than body coat.
 - 2. Color of body coat: Lighter than finish coat.
 - 3. Color prime and body coats to not show through the finish coat and to mask surface imperfections or contrasts.

3.10 MECHANICAL AND ELECTRICAL WORK FIELD PAINTING SCHEDULE

- A. Field painting of mechanical and electrical consists of cleaning, touching-up abraded shop prime coats, and applying prime, body and finish coats to materials and equipment if not factory finished in space scheduled to be finished.
- B. Paint various systems specified in Division 26 - ELECTRICAL.
- C. Paint after tests have been completed.
- D. Omit prime coat from factory prime-coated items.
- E. Color:
 - 1. Color of decorative wall mounted lamps to be the same as original when completed.

Replace Exterior Lighting on Buildings
VAMC LD, Lexington, KY
Project No. 596-12-101

F. Apply paint systems on properly prepared and primed surface as follows:

1. Exterior Locations:

a. Apply two coats of MPI 9 (Exterior Alkyd Enamel (EO)) to the following ferrous metal items:

Vent and exhaust pipes with temperatures under 94 degrees C (200 degrees F), roof drains, fire hydrants, post indicators, yard hydrants, exposed piping and similar items.

3.11 PROTECTION CLEAN UP, AND TOUCH-UP

- A. Protect work from paint droppings and spattering by use of masking, drop cloths, removal of items or by other approved methods.
- B. Upon completion, clean paint from hardware, glass and other surfaces and items not required to be painted of paint drops or smears.
- C. Before final inspection, touch-up or refinished in a manner to produce solid even color and finish texture, free from defects in work which was damaged or discolored.

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SECTION 26 05 11
REQUIREMENTS FOR ELECTRICAL INSTALLATIONS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section applies to all sections of Division 26.
- B. Furnish and install electrical wiring, systems, equipment and accessories in accordance with the specifications and drawings.
- C. Wiring ampacities specified or shown on the drawings are based on copper conductors, with the conduit and raceways accordingly sized. Aluminum conductors are prohibited.

1.2 MINIMUM REQUIREMENTS

- A. References to the International Building Code (IBC), National Electrical Code (NEC), Underwriters Laboratories, Inc. (UL) and National Fire Protection Association (NFPA) are minimum installation requirement standards.
- B. Drawings and other specification sections shall govern in those instances where requirements are greater than those specified in the above standards.

1.3 TEST STANDARDS

- A. All materials and equipment shall be listed, labeled or certified by a nationally recognized testing laboratory to meet Underwriters Laboratories, Inc., standards where test standards have been established. Equipment and materials which are not covered by UL Standards will be accepted provided equipment and material is listed, labeled, certified or otherwise determined to meet safety requirements of a nationally recognized testing laboratory. Equipment of a class which no nationally recognized testing laboratory accepts, certifies, lists, labels, or determines to be safe, will be considered if inspected or tested in accordance with national industrial standards, such as NEMA, or ANSI. Evidence of compliance shall include certified test reports and definitive shop drawings.
- B. Definitions:
 - 1. Listed; Equipment, materials, or services included in a list published by an organization that is acceptable to the authority having jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production or listed equipment or materials or periodic evaluation of services, and whose listing states that the equipment, material, or services either meets appropriate designated standards or has been tested and found suitable for a specified purpose.

2. Labeled; Equipment or materials to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the authority having jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled equipment or materials, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.
3. Certified; equipment or product which:
 - a. Has been tested and found by a nationally recognized testing laboratory to meet nationally recognized standards or to be safe for use in a specified manner.
 - b. Production of equipment or product is periodically inspected by a nationally recognized testing laboratory.
 - c. Bears a label, tag, or other record of certification.
4. Nationally recognized testing laboratory; laboratory which is approved, in accordance with OSHA regulations, by the Secretary of Labor.

1.4 QUALIFICATIONS (PRODUCTS AND SERVICES)

- A. Manufacturers Qualifications: The manufacturer shall regularly and presently produce, as one of the manufacturer's principal products, the equipment and material specified for this project, and shall have manufactured the item for at least three years.
- B. Product Qualification:
 1. The Government reserves the right to require the Contractor to submit a list of installations where the products have been in operation before approval.
- C. Service Qualifications: There shall be a permanent service organization maintained or trained by the manufacturer which will render satisfactory service to this installation within four hours of receipt of notification that service is needed. Submit name and address of service organizations.

1.5 APPLICABLE PUBLICATIONS

Applicable publications listed in all Sections of Division are the latest issue, unless otherwise noted.

1.6 MANUFACTURED PRODUCTS

- A. Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items, for which replacement parts shall be available.
- B. When more than one unit of the same class or type of equipment is required, such units shall be the product of a single manufacturer.

C. Equipment Assemblies and Components:

1. Components of an assembled unit need not be products of the same manufacturer.
2. Manufacturers of equipment assemblies, which include components made by others, shall assume complete responsibility for the final assembled unit.
3. Components shall be compatible with each other and with the total assembly for the intended service.
4. Constituent parts which are similar shall be the product of a single manufacturer.

D. Factory wiring shall be identified on the equipment being furnished and on all wiring diagrams.

E. When Factory Testing Is Specified:

1. The Government shall have the option of witnessing factory tests. The contractor shall notify the VA through the COTR a minimum of 15 working days prior to the manufacturers making the factory tests.
2. Four copies of certified test reports containing all test data shall be furnished to the COTR prior to final inspection and not more than 90 days after completion of the tests.
3. When equipment fails to meet factory test and re-inspection is required, the contractor shall be liable for all additional expenses, including expenses of the Government.

1.7 EQUIPMENT REQUIREMENTS

Where variations from the contract requirements are requested, the connecting work and related components shall include, but not be limited to additions or changes to branch circuits, circuit protective devices, conduits, wire, feeders, controls, panels and installation methods.

1.8 EQUIPMENT PROTECTION

A. Equipment and materials shall be protected during shipment and storage against physical damage, vermin, dirt, corrosive substances, fumes, moisture, cold and rain.

1. Store equipment indoors in clean dry space with uniform temperature to prevent condensation. Equipment shall include but not be limited to circuit protective devices, cables, wire, light fixtures, electronic equipment, and accessories.
2. During installation, equipment shall be protected against entry of foreign matter; and be vacuum-cleaned both inside and outside before testing and operating. Compressed air shall not be used to clean equipment. Remove loose packing and flammable materials from inside equipment.

3. Damaged equipment shall be, as determined by the COTR, placed in first class operating condition or be returned to the source of supply for repair or replacement.
4. Painted surfaces shall be protected with factory installed removable heavy kraft paper, sheet vinyl or equal.
5. Damaged paint on equipment and materials shall be refinished with the same quality of paint and workmanship as used by the manufacturer so repaired areas are not obvious.

1.9 WORK PERFORMANCE

- A. All electrical work must comply with the requirements of NFPA 70 (NEC), NFPA 70B, NFPA 70E, OSHA Part 1910 subpart J, OSHA Part 1910 subpart S and OSHA Part 1910 subpart K in addition to other references required by contract.
- B. Job site safety and worker safety is the responsibility of the contractor.
- C. Electrical work shall be accomplished with all affected circuits or equipment de-energized. When an electrical outage cannot be accomplished in this manner for the required work, the following requirements are mandatory:
 1. Electricians must use full protective equipment (i.e., certified and tested insulating material to cover exposed energized electrical components, certified and tested insulated tools, etc.) while working on energized systems in accordance with NFPA 70E.
 2. Electricians must wear personal protective equipment while working on energized systems in accordance with NFPA 70E.
 3. Before initiating any work, a job specific work plan must be developed by the contractor with a peer review conducted and documented by the COTR and Medical Center staff. The work plan must include procedures to be used on and near the live electrical equipment, barriers to be installed, safety equipment to be used and exit pathways.
 4. Work on energized circuits or equipment cannot begin until prior written approval is obtained from the COTR.
- D. New work shall be installed and connected to existing work neatly, safely and professionally. Disturbed or damaged work shall be replaced or repaired to its prior conditions, as required by Section 01 00 00, GENERAL REQUIREMENTS.
- F. Coordinate location of equipment and conduit with other trades to minimize interferences.

1.10 EQUIPMENT INSTALLATION AND REQUIREMENTS

- A. Equipment location shall be as close as practical to locations shown on the drawings.
- B. Working spaces shall not be less than specified in the NEC for all voltages specified.
- C. Inaccessible Equipment:
 - 1. Where the Government determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, the equipment shall be removed and reinstalled as directed at no additional cost to the Government.
 - 2. "Conveniently accessible" is defined as being capable of being reached quickly for operation, maintenance, or inspections without the use of ladders, or without climbing or crawling under or over obstacles such as, but not limited to, motors, pumps, belt guards, transformers, piping, ductwork, conduit and raceways.

1.11 EQUIPMENT IDENTIFICATION

- A. In addition to the requirements of the NEC, install an identification sign which clearly indicates information required for use and maintenance of items such as separately enclosed circuit breakers, individual breakers, control devices and other significant equipment.

1.12 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. The Government's approval shall be obtained for all equipment and material before delivery to the job site. Delivery, storage or installation of equipment or material which has not had prior approval will not be permitted at the job site.
- C. All submittals shall include adequate descriptive literature, catalog cuts, shop drawings and other data necessary for the Government to ascertain that the proposed equipment and materials comply with specification requirements. Catalog cuts submitted for approval shall be legible and clearly identify equipment being submitted.
- D. Submittals for individual systems and equipment assemblies which consist of more than one item or component shall be made for the system or assembly as a whole. Partial submittals will not be considered for approval.
 - 1. Mark the submittals, "SUBMITTED UNDER SECTION_____".
 - 2. Submittals shall be marked to show specification reference including the section and paragraph numbers.
 - 3. Submit each section separately.

E. The submittals shall include the following:

1. Information that confirms compliance with contract requirements.
Include the manufacturer's name, model or catalog numbers, catalog information, technical data sheets, shop drawings, pictures, nameplate data and test reports as required.
2. Elementary and interconnection wiring diagrams for communication and signal systems, control systems and equipment assemblies. All terminal points and wiring shall be identified on wiring diagrams.
3. Parts list which shall include those replacement parts recommended by the equipment manufacturer.

F. Manuals: Submit in accordance with Section 01 00 00, GENERAL REQUIREMENTS.

1. Maintenance and Operation Manuals: Submit as required for systems and equipment specified in the technical sections. Furnish four copies, bound in hardback binders, (manufacturer's standard binders) or an approved equivalent. Furnish one complete manual as specified in the technical section but in no case later than prior to performance of systems or equipment test, and furnish the remaining manuals prior to contract completion.
2. Inscribe the following identification on the cover: the words "MAINTENANCE AND OPERATION MANUAL," the name and location of the system, equipment, building, name of Contractor, and contract number. Include in the manual the names, addresses, and telephone numbers of each subcontractor installing the system or equipment and the local representatives for the system or equipment.
3. Provide a "Table of Contents" and assemble the manual to conform to the table of contents, with tab sheets placed before instructions covering the subject. The instructions shall be legible and easily read, with large sheets of drawings folded in.
4. The manuals shall include:
 - a. Internal and interconnecting wiring and control diagrams with data to explain detailed operation and control of the equipment.
 - b. A control sequence describing start-up, operation, and shutdown.
 - c. Description of the function of each principal item of equipment.
 - d. Installation instructions.
 - e. Safety precautions for operation and maintenance.
 - f. Diagrams and illustrations.
 - g. Periodic maintenance and testing procedures and frequencies, including replacement parts numbers and replacement frequencies.
 - h. Performance data.

- i. Pictorial "exploded" parts list with part numbers. Emphasis shall be placed on the use of special tools and instruments. The list shall indicate sources of supply, recommended spare parts, and name of servicing organization.
 - j. List of factory approved or qualified permanent servicing organizations for equipment repair and periodic testing and maintenance, including addresses and factory certification qualifications.
- G. Approvals will be based on complete submission of manuals together with shop drawings.
- H. After approval and prior to installation, furnish the COTR with one sample of each of the following:
- 1. A 300 mm (12 inch) length of each type and size of wire and cable along with the tag from the coils of reels from which the samples were taken.
 - 2. Each type of conduit coupling, bushing and termination fitting.
 - 3. Conduit hangers, clamps and supports.
 - 4. Duct sealing compound.
 - 5. Each type of receptacle, toggle switch, occupancy sensor, outlet box, manual motor starter, device wall plate, engraved nameplate, wire and cable splicing and terminating material, and branch circuit single pole molded case circuit breaker.

1.13 ACCEPTANCE CHECKS AND TESTS

The contractor shall furnish the instruments, materials and labor for field tests.

1.14 TRAINING

- A. Training shall be provided in accordance with Article 1.25, INSTRUCTIONS, of Section 01 00 00, GENERAL REQUIREMENTS.
- B. Training shall be provided for the particular equipment or system as required in each associated specification.
- C. A training schedule shall be developed and submitted by the contractor and approved by the COTR at least 30 days prior to the planned training.

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SECTION 26 05 21
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW)

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies the furnishing, installation, and connection of the low voltage power and lighting wiring.

1.2 RELATED WORK

- A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements that are common to more than one section.
- B. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.
- C. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits for cables and wiring.

1.3 QUALITY ASSURANCE

Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 FACTORY TESTS

Low voltage cables shall be thoroughly tested at the factory per NEMA WC-70 to ensure that there are no electrical defects. Factory tests shall be certified.

1.5 SUBMITTALS

In accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, submit the following:

- 1. Manufacturer's Literature and Data: Showing each cable type and rating.
- 2. Certifications: Two weeks prior to the final inspection, submit four copies of the following certifications to the COTR:
 - a. Certification by the manufacturer that the materials conform to the requirements of the drawings and specifications.
 - b. Certification by the contractor that the materials have been properly installed, connected, and tested.

1.6 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are reference in the text by designation only.
- B. American Society of Testing Material (ASTM):
 - D2301-04.....Standard Specification for Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape

C. National Fire Protection Association (NFPA):

70-08.....National Electrical Code (NEC)

D. National Electrical Manufacturers Association (NEMA):

WC 70-09.....Power Cables Rated 2000 Volts or Less for the
Distribution of Electrical Energy

E. Underwriters Laboratories, Inc. (UL):

44-05.....Thermoset-Insulated Wires and Cables

83-08.....Thermoplastic-Insulated Wires and Cables

467-071.....Electrical Grounding and Bonding Equipment

486A-486B-03.....Wire Connectors

486C-04.....Splicing Wire Connectors

486D-05.....Sealed Wire Connector Systems

486E-94.....Equipment Wiring Terminals for Use with Aluminum
and/or Copper Conductors

493-07.....Thermoplastic-Insulated Underground Feeder and
Branch Circuit Cable

514B-04.....Conduit, Tubing, and Cable Fittings

1479-03.....Fire Tests of Through-Penetration Fire Stops

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Conductors and cables shall be in accordance with NEMA WC-70 and as specified herein.

B. Single Conductor:

1. Shall be annealed copper.

2. Shall be stranded for sizes No. 8 AWG and larger, solid for sizes No. 10 AWG and smaller.

3. Shall be minimum size No. 12 AWG, except where smaller sizes are allowed herein.

C. Insulation:

1. XHHW-2 or THHN-THWN shall be in accordance with NEMA WC-70, UL 44, and UL 83.

D. Color Code:

1. Secondary service feeder and branch circuit conductors shall be color-coded as follows:

208/120 volt	Phase	480/277 volt
Black	A	Brown
Red	B	Orange
Blue	C	Yellow

White	Neutral	Gray *
* or white with colored (other than green) tracer.		

- a. Lighting circuit "switch legs" and 3-way switch "traveling wires" shall have color coding that is unique and distinct (e.g., pink and purple) from the color coding indicated above. The unique color codes shall be solid and in accordance with the NEC.
Coordinate color coding in the field with the COTR.
2. Use solid color insulation or solid color coating for No. 12 AWG and No. 10 AWG branch circuit phase, neutral, and ground conductors.
3. Conductors No. 8 AWG and larger shall be color-coded using one of the following methods:
 - a. Solid color insulation or solid color coating.
 - b. Stripes, bands, or hash marks of color specified above.
 - c. Color as specified using 0.75 in [19 mm] wide tape. Apply tape in half-overlapping turns for a minimum of 3 in [75 mm] for terminal points, and in junction boxes, pull-boxes, troughs, and manholes. Apply the last two laps of tape with no tension to prevent possible unwinding. Where cable markings are covered by tape, apply tags to cable, stating size and insulation type.
4. For modifications and additions to existing wiring systems, color coding shall conform to the existing wiring system.

2.2 SPLICES AND JOINTS

- A. In accordance with UL 486A, C, D, E, and NEC.
- B. Aboveground Circuits (No. 10 AWG and smaller):
 1. Connectors: Solderless, screw-on, reusable pressure cable type, rated 600 V, 220° F [105° C], with integral insulation, approved for copper and aluminum conductors.
 2. The integral insulator shall have a skirt to completely cover the stripped wires.
 3. The number, size, and combination of conductors, as listed on the manufacturer's packaging, shall be strictly followed.
- C. Aboveground Circuits (No. 8 AWG and larger):
 1. Connectors shall be indent, hex screw, or bolt clamp-type of high conductivity and corrosion-resistant material, listed for use with copper and aluminum conductors.
 2. Field-installed compression connectors for cable sizes 250 kcmil and larger shall have not fewer than two clamping elements or compression indents per wire.

3. Insulate splices and joints with materials approved for the particular use, location, voltage, and temperature. Splice and joint insulation level shall be not less than the insulation level of the conductors being joined.
4. Plastic electrical insulating tape: Per ASTM D2304, flame-retardant, cold and weather resistant.

2.3 CONTROL WIRING

- A. Unless otherwise specified elsewhere in these specifications, control wiring shall be as specified for power and lighting wiring, except that the minimum size shall be not less than No. 14 AWG.
- B. Control wiring shall be large enough such that the voltage drop under in-rush conditions does not adversely affect operation of the controls.

2.4 WIRE LUBRICATING COMPOUND

- A. Lubricating compound shall be suitable for the wire insulation and conduit, and shall not harden or become adhesive.

PART 3 - EXECUTION

3.1 GENERAL

- A. Install in accordance with the NEC, and as specified.
- B. Install all wiring in raceway systems.
- C. Splice cables and wires only in outlet boxes, junction boxes, pull-boxes, manholes, or handholes.
- D. Wires of different systems (e.g., 120 V, 277 V) shall not be installed in the same conduit or junction box system.
- E. Install cable supports for all vertical feeders in accordance with the NEC. Provide split wedge type which firmly clamps each individual cable and tightens due to cable weight.
- F. For panel boards, cabinets, wireways, switches, and equipment assemblies, neatly form, train, and tie the cables in individual circuits.
- G. Seal cable and wire entering a building from underground between the wire and conduit where the cable exits the conduit, with a non-hardening approved compound.
- H. Wire Pulling:
 1. Provide installation equipment that will prevent the cutting or abrasion of insulation during pulling of cables. Use lubricants approved for the cable.
 2. Use nonmetallic ropes for pulling feeders.
 3. Attach pulling lines for feeders by means of either woven basket grips or pulling eyes attached directly to the conductors, as approved by the COTR.

4. All cables in a single conduit shall be pulled simultaneously.
5. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- I. No more than three single-phase branch circuits shall be installed in any one conduit.

3.2 SPLICE INSTALLATION

- A. Splices and terminations shall be mechanically and electrically secure.
- B. Tighten electrical connectors and terminals according to manufacturer's published torque values.
- C. Where the Government determines that unsatisfactory splices or terminations have been installed, remove the devices and install approved devices at no additional cost to the Government.

3.3 FEEDER IDENTIFICATION

- A. In each interior pull-box and junction box, install metal tags on all circuit cables and wires to clearly designate their circuit identification and voltage. The tags shall be the embossed brass type, 1.5 in [40 mm] in diameter and 40 mils thick. Attach tags with plastic ties.
- B. In each handhole, provide tags of the embossed brass type, showing the circuit identification and voltage. The tags shall be the embossed brass type, 1.5 in [40 mm] in diameter and 40 mils thick. Attach tags with plastic ties.

3.4 EXISTING WIRING

Unless specifically indicated on the plans, existing wiring shall not be reused for a new installation.

3.5 CONTROL AND SIGNAL WIRING INSTALLATION

- A. Unless otherwise specified in other sections, install wiring and connect to equipment/devices to perform the required functions as shown and specified.
- B. Except where otherwise required, install a separate power supply circuit for each system so that malfunctions in any system will not affect other systems.
- C. Where separate power supply circuits are not shown, connect the systems to the nearest panel boards of suitable voltages, which are intended to supply such systems and have suitable spare circuit breakers or space for installation.

3.6 CONTROL AND SIGNAL SYSTEM WIRING IDENTIFICATION

- A. Install a permanent wire marker on each wire at each termination.
- B. Identifying numbers and letters on the wire markers shall correspond to those on the wiring diagrams used for installing the systems.

- C. Wire markers shall retain their markings after cleaning.
- D. In each handhole, install embossed brass tags to identify the system served and function.

3.7 ACCEPTANCE CHECKS AND TESTS

- A. Feeders and branch circuits shall have their insulation tested after installation and before connection to utilization devices, such as fixtures, motors, or appliances. Test each conductor with respect to adjacent conductors and to ground. Existing conductors to be reused shall also be tested.
- B. Applied voltage shall be 500VDC for 300-volt rated cable, and 1000VDC for 600-volt rated cable. Apply test for one minute or until reading is constant for 15 seconds, whichever is longer. Minimum insulation resistance values shall not be less than 25 megohms for 300-volt rated cable and 100 megohms for 600-volt rated cable.
- C. Perform phase rotation test on all three-phase circuits.
- D. The contractor shall furnish the instruments, materials, and labor for all tests.

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SECTION 26 05 26
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the general grounding and bonding requirements for electrical equipment and operations to provide a low impedance path for possible ground fault currents.
- B. "Grounding electrode system" refers to all electrodes required by NEC, as well as made, supplementary, and lightning protection system grounding electrodes.
- C. The terms "connect" and "bond" are used interchangeably in this specification and have the same meaning.

1.2 RELATED WORK

- A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that are common to more than one section of Division 26.
- B. Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Low Voltage power and lighting wiring.

1.3 QUALITY ASSURANCE

Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

- A. Submit in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
- B. Shop Drawings:
 - 1. Clearly present enough information to determine compliance with drawings and specifications.
 - 2. Include the location of system grounding electrode connections and the routing of aboveground and underground grounding electrode conductors.
- C. Test Reports: Provide certified test reports of ground resistance.
- D. Certifications: Two weeks prior to final inspection, submit four copies of the following to the COTR:
 - 1. Certification that the materials and installation are in accordance with the drawings and specifications.
 - 2. Certification by the contractor that the complete installation has been properly installed and tested.

1.5 APPLICABLE PUBLICATIONS

Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.

A. American Society for Testing and Materials (ASTM):

B1-07.....Standard Specification for Hard-Drawn Copper
Wire

B3-07.....Standard Specification for Soft or Annealed
Copper Wire

B8-04.....Standard Specification for Concentric-Lay-
Stranded Copper Conductors, Hard, Medium-Hard,
or Soft

B. Institute of Electrical and Electronics Engineers, Inc. (IEEE):

81-1983.....IEEE Guide for Measuring Earth Resistivity,
Ground Impedance, and Earth Surface Potentials
of a Ground System

C2-07.....National Electrical Safety Code

C. National Fire Protection Association (NFPA):

70-08.....National Electrical Code (NEC)

99-2005.....Health Care Facilities

D. Underwriters Laboratories, Inc. (UL):

44-05Thermoset-Insulated Wires and Cables

83-08Thermoplastic-Insulated Wires and Cables

467-07Grounding and Bonding Equipment

486A-486B-03Wire Connectors

PART 2 - PRODUCTS

2.1 GROUNDING AND BONDING CONDUCTORS

A. Equipment grounding conductors shall be UL 44 or UL 83 insulated stranded copper, except that sizes No. 10 AWG [6 mm²] and smaller shall be solid copper. Insulation color shall be continuous green for all equipment grounding conductors, except that wire sizes No. 4 AWG [25 mm²] and larger shall be identified per NEC.

B. Bonding conductors shall be ASTM B8 bare stranded copper, except that sizes No. 10 AWG [6 mm²] and smaller shall be ASTM B1 solid bare copper wire.

- C. Conductor sizes shall not be less than shown on the drawings, or not less than required by the NEC, whichever is greater.

2.2 GROUND CONNECTIONS

A. Above Grade:

1. Bonding Jumpers: Compression-type connectors, using zinc-plated fasteners and external tooth lockwashers.
2. Connection to Building Steel: Exothermic-welded type connectors.
3. Ground Busbars: Two-hole compression type lugs, using tin-plated copper or copper alloy bolts and nuts.
4. Rack and Cabinet Ground Bars: One-hole compression-type lugs, using zinc-plated or copper alloy fasteners.

2.3 GROUND TERMINAL BLOCKS

At any equipment mounting location (e.g., backboards and hinged cover enclosures) where rack-type ground bars cannot be mounted, provide screw lug-type terminal blocks.

2.4 GROUNDING BUS

Pre-drilled rectangular copper bar with stand-off insulators, minimum 0.25 in [6.3 mm] thick x 4 in [100 mm] high in cross-section, length as shown on drawings, with 0.281 in [7.1 mm] holes spaced 1.125 in [28 mm] apart.

PART 3 - EXECUTION

3.1 GENERAL

- A. Ground in accordance with the NEC, as shown on drawings, and as specified herein.
- B. System Grounding:
 1. Secondary service neutrals: Ground at the supply side of the secondary disconnecting means and at the related transformers.
- C. Equipment Grounding: Metallic structures, including ductwork and building steel, enclosures, raceways, junction boxes, outlet boxes, cabinets, machine frames, and other conductive items in close proximity with electrical circuits, shall be bonded and grounded.
- D. Special Grounding: For patient care area electrical power system grounding, conform to NFPA 99 and NEC.

3.2 INACCESSIBLE GROUNDING CONNECTIONS

Make grounding connections, which are normally buried or otherwise inaccessible (except connections for which access for periodic testing is required), by exothermic weld.

3.3 SECONDARY VOLTAGE EQUIPMENT AND CIRCUITS

- A. Main Bonding Jumper: Bond the secondary service neutral to the ground bus in the service equipment.
- B. Metallic Piping, Building Steel, and Supplemental Electrode(s):
 - 1. Provide a grounding electrode conductor sized per NEC between the service equipment ground bus and all metallic water pipe systems, building steel, and supplemental or made electrodes. Provide jumper insulating joints in the metallic piping. All connections to electrodes shall be made with fittings that conform to UL 467.
 - 2. Provide a supplemental ground electrode and bond to the grounding electrode system.

3.4 RACEWAY

- A. Conduit Systems:
 - 1. Ground all metallic conduit systems. All metallic conduit systems shall contain an equipment grounding conductor.
 - 2. Non-metallic conduit systems, except non-metallic feeder conduits that carry a grounded conductor from exterior transformers to interior or building-mounted service entrance equipment, shall contain an equipment grounding conductor.
 - 3. Conduit that only contains a grounding conductor, and is provided for its mechanical protection, shall be bonded to that conductor at the entrance and exit from the conduit.
 - 4. Metallic conduits which terminate without mechanical connection to an electrical equipment housing by means of locknut and bushings or adapters, shall be provided with grounding bushings. Connect bushings with a bare grounding conductor to the equipment ground bus.
- B. Feeders and Branch Circuits: Install equipment grounding conductors with all feeders and power and lighting branch circuits.
- C. Boxes, Cabinets, Enclosures, and Panelboards:
 - 1. Bond the equipment grounding conductor to each pullbox, junction box, outlet box, device box, cabinets, and other enclosures through which the conductor passes (except for special grounding systems for intensive care units and other critical units shown).
 - 2. Provide lugs in each box and enclosure for equipment grounding conductor termination.
- D. Wireway Systems:

1. Bond the metallic structures of wireway to provide 100% electrical continuity throughout the wireway system, by connecting a No. 6 AWG [16 mm²] bonding jumper at all intermediate metallic enclosures and across all section junctions.
 2. Install insulated No. 6 AWG [16 mm²] bonding jumpers between the wireway system, bonded as required above, and the closest building ground at each end and approximately every 50 ft [16 M].
 3. Use insulated No. 6 AWG [16 mm²] bonding jumpers to ground or bond metallic wireway at each end for all intermediate metallic enclosures and across all section junctions.
 4. Use insulated No. 6 AWG [16 mm²] bonding jumpers to ground cable tray to column-mounted building ground plates (pads) at each end and approximately every 49 ft [15 M].
- E. Receptacles shall not be grounded through their mounting screws. Ground receptacles with a jumper from the receptacle green ground terminal to the device box ground screw and a jumper to the branch circuit equipment grounding conductor.
- F. Ground lighting fixtures to the equipment grounding conductor of the wiring system when the green ground is provided; otherwise, ground the fixtures through the conduit systems. Fixtures connected with flexible conduit shall have a green ground wire included with the power wires from the fixture through the flexible conduit to the first outlet box.
- G. Fixed electrical appliances and equipment shall be provided with a ground lug for termination of the equipment grounding conductor.

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SECTION 26 05 33
RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the furnishing, installation, and connection of conduit, fittings, and boxes, to form complete, coordinated, grounded raceway systems. Raceways are required for all wiring unless shown or specified otherwise.
- B. Definitions: The term conduit, as used in this specification, shall mean any or all of the raceway types specified.

1.2 RELATED WORK

- A. Section 09 91 00, PAINTING: Identification and painting of conduit and other devices.
- F. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that are common to more than one section of Division 26.
- G. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

1.3 QUALITY ASSURANCE

Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

In accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, submit the following:

- A. Manufacturer's Literature and Data: Showing each cable type and rating. The specific item proposed and its area of application shall be identified on the catalog cuts.
- B. Shop Drawings:
 - 1. Size and location of main feeders.
 - 2. Size and location of panels and pull-boxes.
 - 3. Layout of required conduit penetrations through structural elements.
- C. Certifications:
 - 1. Two weeks prior to the final inspection, submit four copies of the following certifications to the COTR:
 - a. Certification by the manufacturer that the material conforms to the requirements of the drawings and specifications.
 - b. Certification by the contractor that the material has been properly installed.

1.5 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.
- B. American National Standards Institute (ANSI):
- C80.1-05.....Electrical Rigid Steel Conduit
 - C80.3-05.....Steel Electrical Metal Tubing
 - C80.6-05.....Electrical Intermediate Metal Conduit
- C. National Fire Protection Association (NFPA):
- 70-08.....National Electrical Code (NEC)
- D. Underwriters Laboratories, Inc. (UL):
- 1-05.....Flexible Metal Conduit
 - 5-04.....Surface Metal Raceway and Fittings
 - 6-07.....Electrical Rigid Metal Conduit - Steel
 - 50-95.....Enclosures for Electrical Equipment
 - 360-093.....Liquid-Tight Flexible Steel Conduit
 - 467-07.....Grounding and Bonding Equipment
 - 514A-04.....Metallic Outlet Boxes
 - 514B-04.....Conduit, Tubing, and Cable Fittings
 - 514C-96.....Nonmetallic Outlet Boxes, Flush-Device Boxes and Covers
 - 651-05.....Schedule 40 and 80 Rigid PVC Conduit and Fittings
 - 651A-00.....Type EB and A Rigid PVC Conduit and HDPE Conduit
 - 797-07.....Electrical Metallic Tubing
 - 1242-06.....Electrical Intermediate Metal Conduit - Steel
- E. National Electrical Manufacturers Association (NEMA):
- TC-2-03.....Electrical Polyvinyl Chloride (PVC) Tubing and Conduit
 - TC-3-04.....PVC Fittings for Use with Rigid PVC Conduit and Tubing
 - FB1-07.....Fittings, Cast Metal Boxes and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable

PART 2 - PRODUCTS

2.1 MATERIAL

- A. Conduit Size: In accordance with the NEC, but not less than 0.5 in [13 mm] unless otherwise shown. Where permitted by the NEC, 0.5 in [13 mm] flexible conduit may be used for tap connections to recessed lighting fixtures.

B. Conduit:

1. Rigid steel: Shall conform to UL 6 and ANSI C80.1.
2. Rigid intermediate steel conduit (IMC): Shall conform to UL 1242 and ANSI C80.6.
3. Electrical metallic tubing (EMT): Shall conform to UL 797 and ANSI C80.3. Maximum size not to exceed 4 in [105 mm] and shall be permitted only with cable rated 600 V or less.
4. Surface metal raceway: Shall conform to UL 5.

C. Conduit Fittings:

1. Rigid steel and IMC conduit fittings:
 - a. Fittings shall meet the requirements of UL 514B and NEMA FB1.
 - b. Standard threaded couplings, locknuts, bushings, conduit bodies, and elbows: Only steel or malleable iron materials are acceptable. Integral retractable type IMC couplings are also acceptable.
 - c. Locknuts: Bonding type with sharp edges for digging into the metal wall of an enclosure.
 - d. Bushings: Metallic insulating type, consisting of an insulating insert, molded or locked into the metallic body of the fitting. Bushings made entirely of metal or nonmetallic material are not permitted.
 - e. Erickson (union-type) and set screw type couplings: Approved for use in concrete are permitted for use to complete a conduit run where conduit is installed in concrete. Use set screws of case-hardened steel with hex head and cup point to firmly seat in conduit wall for positive ground. Tightening of set screws with pliers is prohibited.
 - f. Sealing fittings: Threaded cast iron type. Use continuous drain-type sealing fittings to prevent passage of water vapor. In concealed work, install fittings in flush steel boxes with blank cover plates having the same finishes as that of other electrical plates in the room.
 - g. Setscrew couplings and connectors: Use setscrews of case-hardened steel with hex head and cup point, to firmly seat in wall of conduit for positive grounding.
 - h. Indent-type connectors or couplings are prohibited.
 - i. Die-cast or pressure-cast zinc-alloy fittings or fittings made of "pot metal" are prohibited.
4. Flexible steel conduit fittings:
 - a. Conform to UL 514B. Only steel or malleable iron materials are acceptable.

- b. Clamp-type, with insulated throat.
- 5. Liquid-tight flexible metal conduit fittings:
 - a. Fittings shall meet the requirements of UL 514B and NEMA FB1.
 - b. Only steel or malleable iron materials are acceptable.
 - c. Fittings must incorporate a threaded grounding cone, a steel or plastic compression ring, and a gland for tightening. Connectors shall have insulated throats.
- 6. Surface metal raceway fittings: As recommended by the raceway manufacturer. Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, conduit entry fittings, accessories, and other fittings as required for complete system.
- 8. Expansion and deflection couplings:
 - a. Conform to UL 467 and UL 514B.
 - b. Accommodate a 0.75 in [19 mm] deflection, expansion, or contraction in any direction, and allow 30 degree angular deflections.
 - c. Include internal flexible metal braid, sized to guarantee conduit ground continuity and a low-impedance path for fault currents, in accordance with UL 467 and the NEC tables for equipment grounding conductors.
 - d. Jacket: Flexible, corrosion-resistant, watertight, moisture and heat-resistant molded rubber material with stainless steel jacket clamps.
- D. Conduit Supports:
 - 1. Parts and hardware: Zinc-coat or provide equivalent corrosion protection.
 - 2. Individual Conduit Hangers: Designed for the purpose, having a pre-assembled closure bolt and nut, and provisions for receiving a hanger rod.
 - 3. Multiple conduit (trapeze) hangers: Not less than 1.5 x 1.5 in [38 mm x 38 mm], 12-gauge steel, cold-formed, lipped channels; with not less than 0.375 in [9 mm] diameter steel hanger rods.
 - 4. Solid Masonry and Concrete Anchors: Self-drilling expansion shields, or machine bolt expansion.
- E. Outlet, Junction, and Pull Boxes:
 - 1. UL-50 and UL-514A.
 - 2. Cast metal where required by the NEC or shown, and equipped with rustproof boxes.
 - 3. Sheet metal boxes: Galvanized steel, except where otherwise shown.

4. Flush-mounted wall or ceiling boxes shall be installed with raised covers so that the front face of raised cover is flush with the wall. Surface-mounted wall or ceiling boxes shall be installed with surface-style flat or raised covers.

F. Wireways: Equip with hinged covers, except where removable covers are shown. Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for a complete system.

PART 3 - EXECUTION

3.1 PENETRATIONS

A. Cutting or Holes:

1. Cut holes in advance where they should be placed in the structural elements, such as ribs or beams. Obtain the approval of the COTR prior to drilling through structural elements.
2. Cut holes through concrete and masonry in new and existing structures with a diamond core drill or concrete saw. Pneumatic hammers, impact electric, hand, or manual hammer-type drills are not allowed, except where permitted by the COTR as required by limited working space.

B. Firestop: Where conduits, wireways, and other electrical raceways pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against the spread of fire, smoke and gases.

C. Waterproofing: At floor, exterior wall, and roof conduit penetrations, completely seal clearances around the conduit and make watertight.

3.2 INSTALLATION, GENERAL

- A. In accordance with UL, NEC, as shown, and as specified herein.
- B. Essential (Emergency) raceway systems shall be entirely independent of other raceway systems, except where shown on drawings.
- C. Install conduit as follows:
 1. In complete mechanically and electrically continuous runs before pulling in cables or wires.
 2. Unless otherwise indicated on the drawings or specified herein, installation of all conduits shall be concealed within finished walls, floors, and ceilings.
 3. Flattened, dented, or deformed conduit is not permitted. Remove and replace the damaged conduits with new undamaged material.
 4. Assure conduit installation does not encroach into the ceiling height head room, walkways, or doorways.
 5. Cut square, ream, remove burrs, and draw up tight.

6. Independently support conduit at 8 ft [2.4 M] on centers. Do not use other supports, i.e., suspended ceilings, suspended ceiling supporting members, lighting fixtures, conduits, mechanical piping, or mechanical ducts.
 7. Support within 12 in [300 mm] of changes of direction, and within 12 in [300 mm] of each enclosure to which connected.
 8. Close ends of empty conduit with plugs or caps at the rough-in stage until wires are pulled in, to prevent entry of debris.
 9. Conduit installations under fume and vent hoods are prohibited.
 10. Secure conduits to cabinets, junction boxes, pull-boxes, and outlet boxes with bonding type locknuts. For rigid and IMC conduit installations, provide a locknut on the inside of the enclosure, made up wrench tight. Do not make conduit connections to junction box covers.
 11. Flashing of penetrations of the roof membrane is specified in Section 07 60 00, FLASHING AND SHEET METAL.
 12. Conduit bodies shall only be used for changes in direction, and shall not contain splices.
- D. Conduit Bends:
1. Make bends with standard conduit bending machines.
 2. Conduit hickey may be used for slight offsets and for straightening stubbed out conduits.
 3. Bending of conduits with a pipe tee or vise is prohibited.
- E. Layout and Homeruns:
1. Install conduit with wiring, including homeruns, as shown on drawings.
 2. Deviations: Make only where necessary to avoid interferences and only after drawings showing the proposed deviations have been submitted approved by the COTR.

3.3 CONCEALED WORK INSTALLATION

- A. In Concrete:
1. Conduit: Rigid steel, IMC, or EMT. Do not install EMT in concrete slabs that are in contact with soil, gravel, or vapor barriers.
 2. Align and run conduit in direct lines.
 3. Install conduit through concrete beams only:
 - a. Where shown on the structural drawings.
 - b. As approved by the COTR prior to construction, and after submittal of drawing showing location, size, and position of each penetration.

4. Installation of conduit in concrete that is less than 3 in [75 mm] thick is prohibited.
 - a. Conduit outside diameter larger than one-third of the slab thickness is prohibited.
 - b. Space between conduits in slabs: Approximately six conduit diameters apart, and one conduit diameter at conduit crossings.
 - c. Install conduits approximately in the center of the slab so that there will be a minimum of 0.75 in [19 mm] of concrete around the conduits.
 5. Make couplings and connections watertight. Use thread compounds that are UL approved conductive type to ensure low resistance ground continuity through the conduits. Tightening setscrews with pliers is prohibited.
- B. Above Furred or Suspended Ceilings and in Walls:
1. Conduit for conductors 600 V and below: Rigid steel, IMC, or EMT. Mixing different types of conduits indiscriminately in the same system is prohibited.
 3. Align and run conduit parallel or perpendicular to the building lines.
 4. Connect recessed lighting fixtures to conduit runs with maximum 6 ft [1.8 M] of flexible metal conduit extending from a junction box to the fixture.
 5. Tightening setscrews with pliers is prohibited.

3.4 EXPOSED WORK INSTALLATION

- A. Unless otherwise indicated on the drawings, exposed conduit is only permitted in mechanical and electrical rooms.
- B. Conduit for Conductors 600 V and Below: Rigid steel, IMC, or EMT. Mixing different types of conduits indiscriminately in the system is prohibited.
- C. Align and run conduit parallel or perpendicular to the building lines.
- D. Install horizontal runs close to the ceiling or beams and secure with conduit straps.
- E. Support horizontal or vertical runs at not over 8 ft [2.4 M] intervals.
- F. Surface metal raceways: Use only where shown.
- G. Painting:
 1. Paint exposed conduit as specified in Section 09 91 00, PAINTING.
 2. Refer to Section 09 91 00, PAINTING for preparation, paint type, and exact color. In addition, paint legends, using 2 in [50 mm] high black numerals and letters, showing the cable voltage rating. Provide

legends where conduits pass through walls and floors and at maximum 20 ft [6 M] intervals in between.

3.5 WET OR DAMP LOCATIONS

- A. Unless otherwise shown, use conduits of rigid steel or IMC.
- B. Provide sealing fittings to prevent passage of water vapor where conduits pass from warm to cold locations, i.e., refrigerated spaces, constant-temperature rooms, air-conditioned spaces, building exterior walls, roofs, or similar spaces.
- C. Unless otherwise shown, use rigid steel or IMC conduit within 5 ft [1.5 M] of the exterior and below concrete building slabs in contact with soil, gravel, or vapor barriers. Conduit shall be half-lapped with 10 mil PVC tape before installation. After installation, completely recoat or retape any damaged areas of coating.

3.6 EXPANSION JOINTS

- A. Conduits 3 in [75 mm] and larger that are secured to the building structure on opposite sides of a building expansion joint require expansion and deflection couplings. Install the couplings in accordance with the manufacturer's recommendations.
- B. Provide conduits smaller than 3 in [75 mm] with junction boxes on both sides of the expansion joint. Connect conduits to junction boxes with sufficient slack of flexible conduit to produce 5 in [125 mm] vertical drop midway between the ends. Flexible conduit shall have a bonding jumper installed. In lieu of this flexible conduit, expansion and deflection couplings as specified above for conduits 15 in [375 mm] and larger are acceptable.
- C. Install expansion and deflection couplings where shown.

3.7 CONDUIT SUPPORTS, INSTALLATION

- A. Safe working load shall not exceed one-quarter of proof test load of fastening devices.
- B. Use pipe straps or individual conduit hangers for supporting individual conduits.
- C. Support multiple conduit runs with trapeze hangers. Use trapeze hangers that are designed to support a load equal to or greater than the sum of the weights of the conduits, wires, hanger itself, and 200 lbs [90 kg]. Attach each conduit with U-bolts or other approved fasteners.
- D. Support conduit independently of junction boxes, pull-boxes, fixtures, suspended ceiling T-bars, angle supports, and similar items.
- E. Fasteners and Supports in Solid Masonry and Concrete:
 - 1. New Construction: Use steel or malleable iron concrete inserts set in place prior to placing the concrete.

2. Existing Construction:

- a. Steel expansion anchors not less than 0.25 in [6 mm] bolt size and not less than 1.125 in [28 mm] embedment.
 - b. Power set fasteners not less than 0.25 in [6 mm] diameter with depth of penetration not less than 3 in [75 mm].
 - c. Use vibration and shock-resistant anchors and fasteners for attaching to concrete ceilings.
- E. Hollow Masonry: Toggle bolts.
- F. Bolts supported only by plaster or gypsum wallboard are not acceptable.
- G. Metal Structures: Use machine screw fasteners or other devices specifically designed and approved for the application.
- H. Attachment by wood plugs, rawl plug, plastic, lead or soft metal anchors, or wood blocking and bolts supported only by plaster is prohibited.
- I. Chain, wire, or perforated strap shall not be used to support or fasten conduit.
- J. Spring steel type supports or fasteners are prohibited for all uses except horizontal and vertical supports/fasteners within walls.
- K. Vertical Supports: Vertical conduit runs shall have riser clamps and supports in accordance with the NEC and as shown. Provide supports for cable and wire with fittings that include internal wedges and retaining collars.

3.11 BOX INSTALLATION

- A. Boxes for Concealed Conduits:
- 1. Flush-mounted.
 - 2. Provide raised covers for boxes to suit the wall or ceiling, construction, and finish.
- B. In addition to boxes shown, install additional boxes where needed to prevent damage to cables and wires during pulling-in operations.
- C. Remove only knockouts as required and plug unused openings. Use threaded plugs for cast metal boxes and snap-in metal covers for sheet metal boxes.
- D. Outlet boxes mounted back-to-back in the same wall are prohibited. A minimum 24 in [600 mm] center-to-center lateral spacing shall be maintained between boxes.
- E. Minimum size of outlet boxes for ground fault interrupter (GFI) receptacles is 4 in [100 mm] square x 2.125 in [55 mm] deep, with device covers for the wall material and thickness involved.
- F. Stencil or install phenolic nameplates on covers of the boxes identified on riser diagrams; for example "SIG-FA JB No. 1."

Replace Exterior Lighting on Buildings
VAMC LD, Lexington, KY
Project No. 596-12-101

G. On all branch circuit junction box covers, identify the circuits with
black marker.

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SECTION 26 32 13
ENGINE GENERATORS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the furnishing, installation, connection, and testing of the low-voltage engine generators.

1.2 RELATED WORK

- A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS:
Requirements that apply to all sections of Division 26.
- B. Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Low-voltage conductors.
- C. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS:
Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.
- D. Section 26 36 23, AUTOMATIC TRANSFER SWITCHES: Requirements for automatic transfer switches for use with engine generators.

1.3 QUALITY ASSURANCE

- A. Refer to Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES), in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
- B. A factory-authorized representative shall be capable of providing emergency maintenance and repairs at the project site within 4 hours maximum of notification.

1.4 FACTORY TESTS

- A. Load Test: Shall include two hours while the engine generator is delivering 100% of the specified kW, and four hours while the engine generator is delivering 80% of the specified kW. During this test, record the following data at 20-minute intervals:

Time	Engine RPM	Oil Temperature Out
kW	Water Temperature In	Fuel Pressure
Voltage	Water Temperature Out	Oil Pressure
Amperes	Oil Temperature In	Ambient Temperature

- B. Cold Start Test: Record time required for the engine generator to develop specified voltage, frequency, and kW load from a standstill condition with engine at ambient temperature.

- C. Furnish four (4) copies of certified manufacturer's factory test reports to the COR prior to shipment of the engine generators to ensure that the engine generator has been successfully tested as specified.
- D. The manufacturer shall furnish fuel, load banks, testing instruments, and all other equipment necessary to perform these tests.

1.5 SUBMITTALS

- A. Submit six copies of the following in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
 - 1. Shop Drawings:
 - a. Submit sufficient information to demonstrate compliance with drawings and specifications.
 - b. Scaled drawings, showing plan views, side views, elevations, and cross-sections.
 - 2. Diagrams:
 - a. Control system diagrams, control sequence diagrams or tables, wiring diagrams, interconnections diagrams (between engine generators, automatic transfer switches, paralleling switchgear, local control cubicles, remote annunciator panels, and fuel storage tanks, as applicable), and other like items.
 - 3. Technical Data:
 - a. Published ratings, catalog cuts, pictures, and manufacturer's specifications for engine generator, governor, voltage regulator, radiator, muffler, dampers, day tank, pumps, fuel tank, batteries and charger, jacket heaters, torsional vibration, and control and supervisory equipment.
 - b. Description of operation.
 - c. Short-circuit current capacity and subtransient reactance.
 - d. Sound power level data.
 - 4. Calculations:
 - a. Calculated performance derations appropriate to installed environment.
 - 5. Manuals:
 - a. When submitting the shop drawings, submit complete maintenance and operating manuals, to include the following:
 - 1) Technical data sheets.
 - 2) Wiring diagrams.

- 3) Include information for testing, repair, troubleshooting, and factory recommended periodic maintenance procedures and frequency.
- 4) Provide a replacement and spare parts list. Include a list of tools and instruments for testing and maintenance purposes.
- b. If changes have been made to the maintenance and operating manuals originally submitted, submit updated maintenance and operating manuals two weeks prior to the final inspection.
6. Test Reports:
 - a. Submit certified factory test reports for approval.
 - b. Submit field test reports two weeks prior to the final inspection.
7. Certifications:
 - a. Prior to fabrication of the engine generator, submit the following for approval:
 - 1) A certification in writing that an engine generator of the same model and configuration, with the same bore, stroke, number of cylinders, and equal or higher kW/kVA ratings as the proposed engine generator, has been operating satisfactorily with connected loads of not less than 75% of the specified kW/kVA rating, for not fewer than 2,000 hours without any failure of a crankshaft, camshaft, piston, valve, injector, or governor system.
 - 2) A certification in writing that devices and circuits will be incorporated to protect the voltage regulator and other components of the engine generator during operation at speeds other than the rated RPM while performing maintenance. Submit thorough descriptions of any precautions necessary to protect the voltage regulator and other components of the system during operation of the engine generator at speeds other than the rated RPM.
 - 3) A certification from the engine manufacturer stating that the engine exhaust emissions meet the applicable federal, state, and local regulations and restrictions. At a minimum, this certification shall include emission factors for criteria pollutants including nitrogen oxides, carbon monoxide,

particulate matter, sulfur dioxide, non-methane hydrocarbon,
and hazardous air pollutants (HPAs).

- b. Prior to installation of the engine generator at the job site,
submit certified factory test data.
- c. Two weeks prior to the final inspection, submit the following.
 - 1) Certification by the manufacturer that the engine generators
conform to the requirements of the drawings and
specifications.
 - 2) Certification by the Contractor that the engine generators
have been properly installed, adjusted, and tested.

1.6 STORAGE AND HANDLING

- A. Engine generators shall withstand shipping and handling stresses in
addition to the electrical and mechanical stresses which occur during
operation of the system. Protect radiator core with wood sheet.
- B. Store the engine generators in a location approved by the COR.

1.7 JOB CONDITIONS

- A. Job conditions shall conform to the arrangements and details shown on
the drawings. The dimensions, enclosures, and arrangements of the
engine generator system shall permit the operating personnel to safely
and conveniently operate and maintain the system in the space
designated for installation.

1.8 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions,
supplements, and errata) form a part of this specification to the
extent referenced. Publications are referenced in the text by
designation only.
- B. American National Standards Institute (ANSI):
 - C37.50-07.....Low-Voltage AC Power Circuit Breakers Used In
Enclosures-Test Procedures
 - C39.1-81 (R1992)Requirements for Electrical Analog Indicating
Instruments
- C. American Society of Testing Materials (ASTM):
 - A53/A53M-10.....Standard Specification for Pipe, Steel, Black,
and Hot-Dipped, Zinc Coated Welded and Seamless
 - B88-09.....Specification for Seamless Copper Water Tube
 - B88M-11.....Specification for Seamless Copper water Tube
(Metric)

Replace Exterior Lighting on Buildings
VAMC LD, Lexington, KY
Project No. 596-12-101

- D975-11b.....Diesel Fuel Oils
- D. Institute of Electrical and Electronic Engineers (IEEE):
 - C37.13-08.....Low Voltage AC Power Circuit Breakers Used In Enclosures
 - C37.90.1-02.....Surge Withstand Capability (SWC) Tests for Relays and Relay Systems Associated with Electric Power Apparatus
- E. International Code Council (ICC):
 - IBC-12.....International Building Code
- F. National Electrical Manufacturers Association (NEMA):
 - ICS 6-06.....Enclosures
 - ICS 4-10.....Application Guideline for Terminal Blocks
 - MG 1-11.....Motor and Generators
 - MG 2-07.....Safety Standard and Guide for Selection, Installation and Use of Electric Motors and Generators
 - PB 2-11.....Dead-Front Distribution Switchboards
 - 250-08.....Enclosures for Electrical Equipment (1000 Volts Maximum)
- G. National Fire Protection Association (NFPA):
 - 30-12.....Flammable and Combustible Liquids Code
 - 37-10.....Installations and Use of Stationary Combustion Engine and Gas Turbines
 - 70-11.....National Electrical Code (NEC)
 - 99-12.....Health Care Facilities
 - 110-10.....Standard for Emergency and Standby Power Systems
- H. Underwriters Laboratories, Inc. (UL):
 - 50-07.....Enclosures for Electrical Equipment
 - 142-06.....Steel Aboveground Tanks for Flammable and Combustible Liquids
 - 467-07.....Grounding and Bonding Equipment
 - 489-09.....Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures
 - 508-99.....Industrial Control Equipment
 - 891-05.....Switchboards

1236-06.....Battery Chargers for Charging Engine-Starter
Batteries
2085-97.....Insulated Aboveground Tanks for Flammable and
Combustible Liquids
2200-98.....Stationary Engine Generator Assemblies

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

- A. The engine generator system shall be in accordance with NFPA, UL, NEMA and ANSI, and as specified herein.
- B. Provide a factory-assembled, wired (except for field connections), complete, fully automatic engine generator system.
- C. Engine Generator Parameter Schedule:
 - 1. Power Rating: Emergency Standby
 - 2. Voltage: 120/208V
 - 3. Rated Power: 45 kW/56 kVA continuous
 - 4. Power Factor: 0.8 lagging
 - 5. Engine Generator Application: parallel with utility source
 - 6. Fuel: natural gas
 - 7. Voltage Regulation: + 2% (maximum) (No Load to Full Load)
(standalone applications)
 - 8. Phases: 3 Phase, Wye
- D. Assemble, connect, and wire the engine generator at the factory so that only the external connections need to be made at the construction site.
- E. Engine Generator Unit shall be factory-painted with manufacturer's primer and standard finishes.
- F. Connections between components of the system shall conform to the recommendations of the manufacturer.
- G. Couplings, shafts, and other moving parts shall be enclosed and guarded. Guards shall be metal, ruggedly constructed, rigidly fastened, and readily removable for convenient servicing of the equipment without disassembling any pipes and fittings.
- H. Engine generator shall have the following features:
 - 1. Factory-mounted on a common, rigid, welded, structural steel base.
 - 2. Engine generator shall be statically and dynamically balanced so that the maximum vibration in the horizontal, vertical, and axial directions shall be limited to 0.15 mm (0.0059 inch), with an

overall velocity limit of 24 mm/sec (0.866 inch per second) RMS, for all speeds.

3. The isolators shall be constrained with restraints capable of withstanding static forces in any direction equal to twice the weight of the supported equipment.
4. Shall be capable of operating satisfactorily as specified for not fewer than 10,000 hours between major overhauls.

- I. Each engine generator specified for parallel operation shall be configured for automatic parallel operation.

2.2 ENGINE

- A. The engine shall be coupled directly to a generator.
- B. Minimum four cylinders.
- C. The engine shall be able to start in a 4.5 °C (40 °F) ambient temperature while using No. 2 diesel fuel oil without the use of starting aids such as glow plugs and ether injections.
- D. The engine shall be equipped with electric heater for maintaining the coolant temperature between 32-38 °C (90-100 °F), or as recommended by the manufacturer.
 1. Install thermostatic controls, contactors, and circuit breaker-protected circuits for the heaters.
 2. The heaters shall operate continuously except while the engine is operating or the water temperature is at the predetermined level.

2.3 GOVERNOR

- A. Isochronous, electronic type.
- B. Steady-state speed band at 60 Hz shall not exceed plus or minus 0.33%.

2.4 LUBRICATION OIL SYSTEM

- A. Pressurized type.
- B. Positive-displacement pump driven by engine crankshaft.
- C. Full-flow strainer and full-flow or by-pass filters.
- D. Filters shall be cleanable or replaceable type and shall remove particles as small as 3 microns without removing the additives in the oil. For by-pass filters, flow shall be diverted without flow interruption.
- E. Extend lube oil sump drain line out through the skid base and terminate it with a drain valve and plug.
- F. Provide a 120-volt oil heater for exterior engine generator.

2.5 FUEL SYSTEM

A. Natural Gas.

2.6 COOLING SYSTEM

- A. Liquid-cooled, closed loop, with fin-tube radiator mounted on the engine generator, and integral engine driven circulating pump.
- B. Cooling capacity shall not be less than the cooling requirements of the engine generator and its lubricating oil while operating continuously at 100% of its specified rating.
- C. Water circulating pumps shall be the centrifugal type driven by engine. Incorporate pressure relief devices where required to prevent excessive pressure increase after the engine stops.
- D. Coolant shall be extended-life antifreeze solution, 50% ethylene glycol and 50% soft water, with corrosion inhibitor additive as recommended by the manufacturer.
- E. Fan shall be driven by a totally enclosed electric motor.
- F. Coolant hoses shall be flexible, per manufacturer's recommendation.
- G. Self-contained thermostatic-control valve shall modulate coolant flow to maintain optimum constant coolant temperature, as recommended by the engine manufacturer.
- H. Motor-Operated Dampers:
 - 1. Dampers shall open simultaneously with the starting of the diesel engine and shall close simultaneously with the stopping of the diesel engine.

2.7 AIR INTAKE AND EXHAUST SYSTEMS

- A. Air Intake:
 - 1. Provide an engine-mounted air cleaner with replaceable dry filter and dirty filter indicator.
- B. Exhaust System:
 - 1. Where a turbocharger is required, they shall be engine-mounted, driven by the engine gases, securely braced against vibration and adequately lubricated by the engine's filtered lubrication system.
 - 2. Exhaust Muffler:

Shall be critical grade type and capable of the following noise attenuation:

Octave Band Hertz (Mid Frequency)	Minimum db Attenuation (.0002 Microbar Reference)
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31	5
63	10
125	27
500	37
1000	31
2000	26
4000	25
8000	26

3. Pressure drop in the complete exhaust system shall be small enough for satisfactory operation of the engine generator while it is delivering 100% of its specified rating.
 4. Exhaust pipe size from the engine to the muffler shall be as recommended by the engine manufacturer. Pipe size from muffler to air discharge shall be two pipe sizes larger than engine exhaust pipe.
 5. Connections at the engine exhaust outlet shall be made with a flexible exhaust pipe. Provide bolted type pipe flanges welded to each end of the flexible section.
- C. Condensate drain at muffler shall be made with schedule 40 black steel pipe through a petcock.
- D. Exhaust Piping and Supports: Black steel pipe, ASTM A-53 standard weight with welded fittings. Spring type hangers.
- E. Insulation for Exhaust Pipe and Muffler:
1. Calcium silicate minimum 75 mm (3 inches) thick.
 2. The installed insulation shall be covered with aluminum jacket 0.4 mm (0.016 inch) thick. The jacket is to be held in place by bands of 0.38 mm (0.015 inch) thick by 15 mm (0.5 inch) wide aluminum.
 3. Insulation and jacket are not required on flexible exhaust sections.
- F. Roof Sleeves: Pipe sleeves (thimble) shall be Schedule 40 standard weight steel pipe. Flash exhaust pipe thimble through roof with 16 oz soft sheet copper, flanged, and made watertight under built-up roofing and extended up around pipe thimble. The exhaust pipe shall be positioned within the thimble by four 150 mm (6 inches) wide spiders welded to the exhaust pipe.
- G. Vertical exhaust piping shall be provided with a hinged, gravity-operated, self-closing rain cover.

2.8 ENGINE STARTING SYSTEM

- A. The engine starting system shall start the engine at any position of the flywheel.
- B. Electric cranking motor:
 - 1. Shall be engine-mounted.
 - 2. Shall crank the engine via a gear drive.
 - 3. Rating shall be adequate for cranking the cold engine at the voltage provided by the battery system, and at the required RPM during five consecutive starting attempts of 10 seconds cranking each at 10-second intervals, for a total of 50 seconds of actual cranking without damage (the fifth starting attempt will be manually initiated upon failure of a complete engine cranking cycle).
- C. Batteries shall be nickel-cadmium high discharge rate type.
 - 1. Each battery cell shall have minimum and maximum electrolyte level indicators and a flip-top flame arrestor vent cap.
 - 2. Batteries shall have connector covers for protection against external short circuits.
 - 3. With the charger disconnected, the batteries shall have sufficient capacity so that the total system voltage does not fall below 85% of the nominal system voltage with the following demands:
Five consecutive starting attempts of 10 seconds cranking at 10 second intervals for a total of 50 seconds of actual cranking (the fifth starting attempt will be manually initiated upon failure of a complete engine cranking cycle).
 - 4. Battery racks shall be metal with an alkali-resistant finish and thermal insulation, and secured to the floor.
- D. Battery Charger:
 - 1. A current-limiting battery charger, conforming to UL 1236, shall be provided and shall automatically recharge the batteries. The charger shall be capable of an equalize-charging rate for recharging fully depleted batteries within 24 hours and a floating charge rate for maintaining the batteries at fully charged condition.
 - 2. An ammeter shall be provided to indicate charging rate. A voltmeter shall be provided to indicate charging voltage.

2.9 LUBRICATING OIL HEATER

- A. Provide a thermostatically-controlled electric heater to automatically maintain the oil temperature within plus or minus 1.7 °C (3 °F) of the control temperature.

2.10 JACKET COOLANT HEATER

- A. Provide a thermostatically-controlled electric heater mounted in the engine coolant jacketing to automatically maintain the coolant within plus or minus 1.7 °C (3 °F) of the temperature recommended by the engine manufacturer to meet the starting time specified at the minimum winter outdoor temperature.

2.11 GENERATOR

- A. Synchronous, amortisseur windings, bracket-bearing, self-venting, rotating-field type connected directly to the engine.
- B. Lifting lugs designed for convenient connection to and removal from the engine.
- C. Integral poles and spider, or individual poles dove-tailed to the spider.
- D. Designed for sustained short-circuit currents in conformance with NEMA Standards.
- E. Designed for sustained operation at 100% of the RPM specified for the engine generator without damage.
- F. Telephone influence factor shall conform to NEMA MG 1.
- G. Furnished with brushless excitation system or static-exciter-regulator assembly.
- H. Nameplates attached to the generator shall show the manufacturer's name, equipment identification, serial number, voltage ratings, field current ratings, kW/kVA output ratings, power factor rating, time rating, temperature rise ratings, RPM ratings, full load current rating, number of phases and frequency, and date of manufacture.
- I. The grounded (neutral) conductor shall be electrically isolated from equipment ground and terminated in the same junction box as the phase conductors.

2.12 GENERATOR OVERCURRENT AND FAULT PROTECTION

- A. Generator circuit breaker shall be molded case type. Molded case circuit breaker shall have automatic, trip free, non-adjustable, inverse time and instantaneous magnetic trips for 200 A frame size or less. Magnetic trip shall be adjustable from 5x to 10x for breakers

with 200 A frame size and higher. Factory setting shall be LOW unless otherwise noted. Provide shunt trip to trip breaker when engine generator is shut down by other protective devices.

- B. Integrate ground-fault indication with other engine generator alarm indications.
- C. Overcurrent protective device cubicle shall contain terminations for neutral and equipment grounding conductors as necessary.

2.13 CONTROLS

- A. Shall include Engine Generator Control Cubicle(s) and Remote Annunciator Panel.
- B. General:
 - 1. Control equipment shall be in accordance with UL 508, NEMA ICS-4, ICS-6, and ANSI C37.90.1.
 - 2. Panels shall be in accordance with UL 50.
 - 3. Cubicles shall be in accordance with UL 891.
 - 4. Coordinate controls with the automatic transfer switches shown on the drawings so that the systems will operate as specified.
 - 5. Cubicles:
 - a. Code gauge steel: manufacturer's recommended heavy gauge steel with factory primer and light gray finish.
 - b. Doors shall be gasketed, attached with concealed or semi-concealed hinges, and shall have a permanent means of latching in closed position.
 - c. Panels shall be wall-mounted or incorporated in other equipment as indicated on the drawings or as specified.
 - d. Door locks for panels and cubicles shall be keyed identically to operate from a single key.
 - 6. Wiring: Insulated, rated at 600 V.
 - a. Install the wiring in vertical and horizontal runs, neatly harnessed.
 - b. Terminate all external wiring at heavy duty, pressure-type, terminal blocks.
 - 7. The equipment, wiring terminals, and wires shall be clearly and permanently labeled.
 - 8. The appropriate wiring diagrams shall be laminated or mounted under plexiglass within the frame on the inside of the cubicles and panels.

9. All indicating lamps and switches shall be accessible and mounted on the cubicle doors.
 10. Meters shall be per the requirements of Section 25 10 10, ADVANCED UTILITY METERING.
 11. The manufacturer shall coordinate the interconnection and programming of the generator controls with all related equipment, including automatic transfer switches and generator paralleling controls as applicable, specified in other sections.
- C. Engine generator Control Cubicle:
1. Starting and Stopping Controls:
 - a. A three-position, maintained-contact type selector switch with positions marked "AUTOMATIC," "OFF," and "MANUAL." Provide flashing amber light for OFF and MANUAL positions.
 - b. A momentary contact push-button switch with positions marked "MANUAL START" and "MANUAL STOP."
 - c. Selector switch in AUTOMATIC position shall cause the engine to start automatically when a single pole contact in a remote device closes. When the generator's output voltage increases to not less than 90% of its rated voltage, and its frequency increases to not less than 58 Hz, the remote devices shall transfer the load to the generator. An adjustable time delay relay, in the 0 to 15 minute range, shall cause the engine generator to continue operating without any load after completion of the period of operation with load. Upon completion of the additional 0 to 15 minute (adjustable) period, the engine generator shall stop.
 - d. Selector switch in OFF position shall prevent the engine from starting either automatically or manually. Selector switch in MANUAL position shall also cause the engine to start when the manual start push-button is depressed momentarily.
 - e. With selector switch is in MANUAL position, depressing the MANUAL STOP push-button momentarily shall stop the engine after a cool-down period.
 - f. A maintained-contact, red mushroom-head push-button switch marked "EMERGENCY STOP" will cause the engine to stop without a cool-down period, independent of the position of the selector switch.

2. Engine Cranking Controls:

- a. The cranking cycles shall be controlled by a timer that will be independent of the battery voltage fluctuations.
- b. The controls shall crank the engine through one complete cranking cycle, consisting of four starting attempts of 10 seconds each with 10 seconds between each attempt.
- c. Total actual cranking time for the complete cranking cycle shall be 40 seconds during a 70-second interval.
- d. Cranking shall terminate when the engine starts so that the starting system will not be damaged. Termination of the cranking shall be controlled by self-contained, speed-sensitive switch. The switch shall prevent re-cranking of the engine until after the engine stops.
- e. After the engine has stopped, the cranking control shall reset.

3. Supervisory Controls:

a. Overcrank:

- 1) When the cranking control system completes one cranking cycle (four starting attempts), without starting the engine, the OVERCRANK signal light and the audible alarm shall be energized.
- 2) The cranking control system shall lock-out, and shall require a manual reset.

b. Coolant Temperature:

- 1) When the temperature rises to the predetermined first stage level, the HIGH COOLANT TEMPERATURE - FIRST STAGE signal light and the audible alarm shall be energized.
- 2) When the temperature rises to the predetermined second stage level, which shall be low enough to prevent any damage to the engine and high enough to avoid unnecessary engine shutdowns, the HIGH COOLANT TEMPERATURE - SECOND STAGE signal light and the audible alarm shall be energized and the engine shall stop.
- 3) The difference between the first and second stage temperature settings shall be approximately -12 °C (10 °F).
- 4) Permanently indicate the temperature settings near the associated signal light.

- 5) When the coolant temperature drops to below 21 °C (70 °F), the "LOW COOLANT TEMPERATURE" signal light and the audible alarm shall be energized.
- c. Low Coolant Level: When the coolant level falls below the minimum level recommended by the manufacturer, the LOW COOLANT LEVEL signal light and audible alarm shall be energized.
- d. Lubricating Oil Pressure:
 - 1) When the pressure falls to the predetermined first stage level, the OIL PRESSURE - FIRST STAGE signal light and the audible alarm shall be energized.
 - 2) When the pressure falls to the predetermined second stage level, which shall be high enough to prevent damage to the engine and low enough to avoid unnecessary engine shutdowns, the OIL PRESSURE - SECOND STAGE signal light and the audible alarm shall be energized and the engine shall stop.
 - 3) The difference between the first and second stage pressure settings shall be approximately 15% of the oil pressure.
 - 4) The pressure settings near the associated signal light shall be permanently displayed so that the running oil pressure can be compared to the target (setpoint) value.
- e. Overspeed:
 - 1) When the engine RPM exceeds the maximum RPM recommended by the manufacturer of the engine, the engine shall stop.
 - 2) Simultaneously, the OVERSPEED signal light and the audible alarm shall be energized.
- f. Low Fuel - Day Tank:

When the fuel oil level in the day tank decreases to less than the level at which the fuel oil transfer pump should start to refill the tank, the LOW FUEL DAY TANK light and the audible alarm shall be energized.
- g. Low Fuel - Main Storage Tank:

When the fuel oil level in the storage tank decreases to less than one-third of total tank capacity, the LOW FUEL-MAIN STORAGE TANK signal light and audible alarm shall be energized.
- h. Reset Alarms and Signals:

Overcrank, Coolant Temperature, Coolant Level, Oil Pressure, Overspeed, and Low Fuel signal lights and the associated audible

alarms shall require manual reset. A momentary-contact silencing switch and push-button shall silence the audible alarm by using relays or solid state devices to seal in the audible alarm in the de-energized condition. Elimination of the alarm condition shall automatically release the sealed-in circuit for the audible alarm so that it will be automatically energized again when the next alarm condition occurs. The signal lights shall require manual reset after elimination of the condition which caused them to be energized. Install the audible alarm just outside the engine generator room in a location as directed by the COR. The audible alarm shall be rated for 85 dB at 3 M (10 feet).

i. Generator Breaker Signal Light:

- 1) A flashing green light shall be energized when the engine generator circuit breaker is in the OPEN or TRIPPED position.
- 2) Simultaneously, the audible alarm shall be energized.

4. Monitoring Devices:

- a. Electric type gauges for the cooling water temperatures and lubricating oil pressures. These gauges may be engine mounted with proper vibration isolation.
- b. A running time indicator, totalizing not fewer than 9,999 hours, and an electric type tachometer.
- c. A voltmeter, ammeter, frequency meter, kilowatt meter, manual adjusting knob for the output voltage, and the other items shown on the drawings shall be mounted on the front of the generator control panels.
- d. Install potential and current transformers as required.
- e. Visual Indications:
 - 1) OVERCRANK
 - 2) HIGH COOLANT TEMPERATURE - FIRST STAGE
 - 3) HIGH COOLANT TEMPERATURE - SECOND STAGE
 - 4) LOW COOLANT TEMPERATURE
 - 5) OIL PRESSURE - FIRST STAGE
 - 6) OIL PRESSURE - SECOND STAGE
 - 7) LOW COOLANT LEVEL
 - 8) GENERATOR BREAKER
 - 9) OVERSPEED
 - 10) LOW FUEL - DAY TANK

11) LOW FUEL - MAIN STORAGE TANK

- f. Lamp Test: The LAMP TEST momentary contact switch shall momentarily actuate the alarm buzzer and all the indicating lamps.

5. Automatic Voltage Regulator:

- a. Shall correct voltage fluctuations rapidly and restore the output voltage to the predetermined level with a minimum amount of hunting.
- b. Shall include voltage level rheostat located inside the control cubicle.
- c. Provide a 3-phase automatic voltage regulator immune to waveform distortion.

2.14 REMOTE ANNUNCIATOR PANEL

- A. A remote annunciator panel shall be installed at the location as shown on the drawings.
- B. The annunciator shall indicate alarm conditions as required by NFPA 99 and 110.
- C. Include control wiring between the remote annunciator panel and the engine generator. Wiring shall be as required by the manufacturer.

2.15 SOUND-ATTENUATED ENCLOSURE

- A. The engine generator and related equipment shall be housed in an outdoor weatherproof enclosure.
- B. The enclosure shall be provided with a factory-installed and factory-wired panelboard, 20A 120V receptacles, and compact fluorescent light fixtures with guards and switches.
- C. Enclosure shall be weatherproof and sound-attenuated (maximum 85 dBA at 1525 mm (5 feet) from any side, top and bottom to no more than 75 dBA when measured at 15 M (50 feet) horizontally from any part of the enclosure). Sound ratings shall be based on full load condition of engine generator in a single unit operation condition.
- D. Airflow configuration shall be intake through rear of unit, and discharge air vertically up. Enclosure shall be suitable for winds up to 193 kmh (120 miles per hour) roof load shall be equal to or greater than 200 kg/sq m (40 pounds per square foot) Non-distributed loading as required.
- E. The enclosure shall meet the following requirements:

1. Radiator exhaust outlet shall be ducted through the end of the enclosure.
2. All exterior surfaces shall be factory-painted with industrial enamel.
3. Unit shall have sufficient guards to prevent entrance by small animals.
4. Batteries shall fit inside enclosure and alongside the engine generator. Batteries under the generator are not acceptable.
5. The muffler shall be mounted and thermally-insulated inside the enclosure.

2.16 SPARE PARTS

- A. For each engine generator:
 1. Six lubricating oil filters.
 2. Six primary fuel oil filters.
 3. Six secondary fuel oil filters.
 4. Six intake air filters.
- B. For each battery charger:
 1. Three complete sets of fuses.
- C. For each control panel:
 1. Three complete sets of fuses, if applicable.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install concrete bases of dimensions shown on the drawings.
- B. Installation of the engine generator shall comply with manufacturer's written instructions and with NFPA 110.
- C. Mounting:
 1. Support the base of engine generator on vibration isolators, each isolator bolted to the floor (pad), and the generator base bolted to isolator.
 2. Install sufficient isolators so that the floor (pad) bearing pressure under each isolator is within the floor (pad) loading specification.
 3. Install equal number of isolators on each side of the engine generator's base.
 4. Locate isolators for approximately equal load distribution and deflection per isolator. The base of the engine generator shall be drilled at the factory for the isolator bolts.

5. Isolators shall be shipped loose with the engine generator.
6. All connections between the engine generator and exterior systems, such as fuel lines, electrical connections, and engine exhaust system and air exhaust shroud, shall be flexible.

D. Balance:

1. The vibration velocity in the horizontal, vertical, and axial directions shall not exceed 16.25 mm (0.65 inch) per second peak at any specific frequency. These limits apply to main structural components such as the engine block and the generator frame at the bearings.

E. Connect all components of the generator system so that they will continue to be energized during failure of the normal electrical power supply system.

F. Install piping between engine generator and remote components of cooling, fuel, and exhaust systems.

G. Flexible connection between radiator and exhaust shroud at the wall damper:

1. Install noncombustible flexible connections made of 20-oz neoprene-coated fiberglass fabric approximately 150 mm (6 inches) wide.
2. Crimp and fasten the fabric to the sheet metal with screws 50 mm (2 inches) on center. The fabric shall not be stressed, except by the air pressure.

H. Exhaust System Insulation:

1. Adhesive and insulation materials shall be applied on clean, dry surfaces from which loose scale and construction debris has been removed by wire brushing.
2. Fill all cracks, voids, and joints of applied insulation material with high temperature 1093 °C (2000 °F) insulating cement before applying the outer covering.
3. The installation shall be clean and free of debris, thermally and structurally tight without sag, neatly finished at all hangers or other penetrations, and shall provide a smooth finished surface.
4. Insulation and jacket shall terminate hard and tight at all anchor points.
5. Insulate completely from engine exhaust flexible connection through roof or wall construction, including muffler.

3.2 ACCEPTANCE CHECKS AND TESTS

- A. Provide the services of a factory-authorized, factory-trained representative of the engine generator manufacturer to inspect field-assembled components and equipment installation, and to supervise the field tests.
- B. When the complete engine generator system has been installed and prior to the final inspection, test all components of the system in the presence of the COR for proper operation of the individual components and the complete system and to eliminate electrical and mechanical defects.
- C. Furnish fuel oil, lubricating oil, anti-freeze liquid, water treatment, rust-inhibitor, and load bank for testing of the engine generator.
- D. Visual Inspection: Visually verify proper installation of engine generator and all components per manufacturer's pre-functional installation checklist.
- E. Field Tests:
 - 1. Perform manufacturer's after-starting checks and inspections.
 - 2. Test the engine generator for six hours of continuous operation as follows:
 - a. Two hours while delivering 100% of the specified kW.
 - b. Four hours while the engine generator is delivering 80% of its specified kW rating.
 - c. If during the 6-hour continuous test, an engine generator failure occurs or the engine generator cannot maintain specified power output, the test(s) are null and void. After repair and/or adjustments, the test(s) shall be repeated at no additional cost to the Government until satisfactory results are attained.
 - 3. Record the following test data at 30-minute intervals:
 - a. Time of day, as well as reading of running time indicator.
 - b. kW.
 - c. Voltage on each phase.
 - d. Amperes on each phase.
 - e. Engine RPM.
 - f. Frequency.
 - g. Coolant water temperature.
 - h. Fuel pressure.
 - i. Oil pressure.

- j. Outdoor temperature.
 - k. Average ambient temperature in the vicinity of the engine generator.
 - 4. Demonstrate that the engine generator will attain proper voltage and frequency within the specified time limit from a cold start after the closing of a single contact.
 - 5. Furnish a resistance-type load for the testing of the engine generator. Test loads shall always include adequate resistance to assure stability of the loads and equipment during all of the testing operations. The test load kW rating shall not be less than 100% of the specified kW rating of the engine generator.
- F. Starting System Test:
- 1. Demonstrate that the batteries and cranking motor are capable of five starting attempts of 10 seconds cranking each at 10-second intervals with the battery charger turned off.
- G. Remote Annunciator Panel Tests:
- Simulate conditions to verify proper operation of each visual or audible indication, interconnecting hardware and software, and reset button.
- H. Automatic Operation Tests:
- Test the engine generator and associated automatic transfer switches to demonstrate automatic starting, loading and unloading. The load for this test shall be the actual connected loads. Initiate loss of normal source and verify the specified sequence of operation. Restore the normal power source and verify the specified sequence of operation. Verify resetting of controls to normal.

3.3 FOLLOW-UP VERIFICATION

- A. After completion of acceptance checks, settings, and tests, the Contractor shall demonstrate that the engine generator(s) and control and annunciation components are in good operating condition and properly performing the intended function.

3.4 INSTRUCTIONS AND FINAL INSPECTIONS

- A. Laminate or mount under acrylic resin a set of operating instructions for the system and install instructions within a frame mounted on the wall near the engine generator at a location per the COR.

Replace Exterior Lighting on Buildings
VAMC LD, Lexington, KY
Project No. 596-12-101

B. Furnish the services of a competent, factory-trained technician for one 4-hour period for instructions to VA personnel in operation and maintenance of the equipment, on the date requested by the COR.

---END---

SECTION 26 36 23
AUTOMATIC TRANSFER SWITCHES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section specifies the furnishing, installation, connection, and testing of open-transition automatic transfer switches with bypass isolation, indicated as automatic transfer switches or ATS in this section.

1.2 RELATED WORK

- A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS:
Requirements that apply to all sections of Division 26.
- B. Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES:
Low-voltage conductors.
- C. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS:
Requirements for personal safety and to provide a low impedance path for possible ground fault currents.
- D. Section 26 05 33, RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS: Conduits.
- E. Section 26 32 13, ENGINE-GENERATORS: Requirements for normal and emergency power generation.

1.3 QUALITY ASSURANCE

- A. QUALITY ASSURANCE
Refer to Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES), in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
- B. A factory-authorized representative shall be capable of providing emergency maintenance and repairs at the project site within 4 hours maximum of notification.
- C. Automatic transfer switch, bypass/isolation switch, and annunciation control panels shall be products of the same manufacturer.

1.4 FACTORY TESTS

- A. Automatic transfer switches shall be thoroughly tested at the factory to ensure that there are no electrical or mechanical defects. Tests shall be conducted per UL standards. Factory tests shall be certified, and shall include the following tests:
 - 1. Visual inspection to verify that each ATS is as specified.
 - 2. Mechanical test to verify that ATS sections are free of mechanical hindrances.

3. Insulation resistance test to ensure electrical integrity and continuity of entire system.
 4. Main switch contact resistance test.
 5. Electrical tests to verify complete system electrical operation.
- B. Furnish four (4) copies of certified manufacturer's factory test reports to the COR prior to shipment of the ATS to ensure that the ATS has been successfully tested as specified.

1.5 SUBMITTALS

- A. Submit six copies of the following in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
1. Shop Drawings:
 - a. Submit sufficient information to demonstrate compliance with drawings and specifications.
 - b. Include voltage rating, continuous current rating, number of phases, withstand and closing rating, dimensions, weights, mounting details, conduit entry provisions, front view, side view, equipment and device arrangement, elementary and interconnection wiring diagrams, factory relay settings, and accessories.
 - c. For automatic transfer switches that are networked together to a common means of annunciation and/or control, submit interconnection diagrams as well as site and building plans, showing connections for normal and emergency sources of power, load, control and annunciation components, and interconnecting communications paths. Equipment locations on the diagrams and plans shall match the site, building, and room designations on the drawings.
 - d. Complete nameplate data, including manufacturer's name and catalog number.
 - e. A copy of the markings that are to appear on the automatic transfer switches when installed.
 2. Manuals:
 - a. Submit, simultaneously with the shop drawings, companion copies of complete maintenance and operating manuals, including technical data sheets, wiring diagrams, and information for ordering replacement parts.

- 1) Schematic signal and control diagrams, with all terminals identified, matching terminal identification in the automatic transfer switches.
- 2) Include information for testing, repair, troubleshooting, assembly, disassembly, and factory recommended/required periodic maintenance procedures and frequency.
- 3) Provide a replacement and spare parts list. Include a list of tools and instruments for testing and maintenance purposes.
- b. If changes have been made to the maintenance and operating manuals originally submitted, submit updated maintenance and operating manuals two weeks prior to the final inspection.
 - 1) Include complete "As Installed" diagrams that indicate all pieces of equipment and their interconnecting wiring.
 - 2) Include complete diagrams of the internal wiring for each piece of equipment, including "As Installed" revisions of the diagrams.
 - 3) The wiring diagrams shall identify the terminals to facilitate installation, maintenance, operation, and testing.
3. Certifications:
 - a. When submitting the shop drawings, submit a certified test report from a recognized independent testing laboratory that a representative sample has passed UL 1008 prototype testing.
 - b. Two weeks prior to final inspection, submit the following.
 - 1) Certification by the manufacturer that the ATS conform to the requirements of the drawings and specifications.
 - 2) Certification by the Contractor that transfer switches have been properly installed, adjusted, and tested.

1.6 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.
- B. Institute of Electrical and Electronic Engineers (IEEE):
446-95.....Emergency and Standby Power Systems for
Industrial and Commercial ApplicationsC37.90.1-
02 Surge Withstand Capability (SWC) Tests

- for Relays and Relay Systems Associated with
Electric Power Apparatus
- C62.41.1-02.....Guide on the Surges Environment in Low-Voltage
(1000 V and Less) AC Power Circuits
- C62.41.2-02.....Recommended Practice on Characterization of
Surges in Low-Voltage (1000 V and Less) AC
Power Circuits
- C. International Code Council (ICC):
 - IBC-12.....International Building Code
- D. National Electrical Manufacturers Association (NEMA):
 - 250-08.....Enclosures for Electrical Equipment (1000 Volts
Maximum)
 - ICS 6-06.....Enclosures
 - ICS 4-10.....Application Guideline for Terminal Blocks
 - MG 1-11.....Motors and Generators
- E. National Fire Protection Association (NFPA):
 - 70-11.....National Electrical Code (NEC)
 - 99-12.....Health Care Facilities
 - 110-10.....Emergency and Standby Power Systems
- F. Underwriters Laboratories, Inc. (UL):
 - 50-95.....Enclosures for Electrical Equipment
 - 508-99.....Industrial Control Equipment
 - 891-07.....Switchboards
 - 1008-07.....Transfer Switch Equipment

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

- A. Automatic transfer switches shall comply with UL, NEMA, NEC, ANSI, IEEE, and NFPA, and have the following features:
 - 1. Automatic transfer switches shall be open transition switches, 4-pole, draw-out construction, electrically operated, mechanically held open contact type, without integral overcurrent protection. Automatic transfer switches utilizing automatic or non-automatic molded case circuit breakers, insulated case circuit breakers, or power circuit breakers as switching mechanisms are not acceptable.
 - 2. Automatic transfer switches shall be completely factory-assembled and wired such that only external circuit connections are required in the field.

3. Each automatic transfer switch shall be equipped with an integral bypass/isolation switch.
4. Ratings:
 - a. Phases, voltage, continuous current, poles, and withstand and closing ratings shall be as shown on the drawings.
 - b. Transfer switches are to be rated for continuous duty at specified continuous current rating on 60Hz systems.
 - c. Maximum automatic transfer switch rating: 200 A.
5. Markings:
 - a. Markings shall be in accordance with UL 1008.
6. Tests:
 - a. Automatic transfer switches shall be tested in accordance with UL 1008. The contacts of the transfer switch shall not weld during the performance of withstand and closing tests when used with the upstream overcurrent device and available fault current specified.
7. Surge Withstand Test:
 - a. Automatic transfer switches utilizing solid-state devices in sensing, relaying, operating, or communication equipment or circuits shall comply with IEEE C37.90.1.
8. Housing:
 - a. Enclose automatic transfer switches in wall- or floor-mounted steel cabinets, with metal gauge not less than No. 14, in accordance with UL 508, or in a switchboard assembly in accordance with UL 891, as shown on the drawings.
 - b. Enclosure shall be constructed so that personnel are protected from energized bypass-isolation components during automatic transfer switch maintenance.
 - c. Automatic transfer switch components shall be removable without disconnecting external source or load power conductors.
 - d. Finish: Cabinets shall be given a phosphate treatment, painted with rust-inhibiting primer, and finish-painted with the manufacturer's standard enamel or lacquer finish.
 - e. Viewing Ports: Provide viewing ports so that contacts may be inspected without disassembly.
9. Operating Mechanism:
 - a. Actuated by an electrical operator.

- b. Electrically and mechanically interlocked so that the main contact cannot be closed simultaneously in either normal and emergency position.
 - c. Normal and emergency main contacts shall be mechanically locked in position by the operating linkage upon completion of transfer. Release of the locking mechanism shall be possible only by normal operating action.
 - d. Contact transfer time shall not exceed six cycles.
 - e. Operating mechanism components and mechanical interlocks shall be insulated or grounded.
10. Contacts:
- a. Main contacts: Silver alloy.
 - b. Neutral contacts: Silver alloy, with same current rating as phase contacts.
 - c. Current carrying capacity of arcing contacts shall not be used in the determination of the automatic transfer switch rating, and shall be separate from the main contacts.
 - d. Main and arcing contacts shall be visible for inspection with cabinet door open and barrier covers removed.
11. Manual Operator:
- a. Capable of operation by one person in either direction under no load.
12. Replaceable Parts:
- a. Include the main and arcing contacts individually or as units, as well as relays, and control devices.
 - b. Automatic transfer switch contacts and accessories shall be replaceable from the front without removing the switch from the cabinet and without removing main conductors.
13. Sensing Features:
- a. Undervoltage Sensing for Each Phase of Normal Source: Sense low phase-to-ground voltage on each phase. Pickup voltage shall be adjustable from 85 to 100% of nominal, and dropout voltage is adjustable from 75 to 98% of pickup value. Factory set for pickup at 90% and dropout at 85%.
 - b. Adjustable Time Delay: For override of normal-source voltage sensing to delay transfer and engine start signals. Adjustable from zero to six seconds, and factory set for one second.

- c. Voltage/Frequency Lockout Relay: Prevent premature transfer to the engine-generator. Pickup voltage shall be adjustable from 85 to 100% of nominal. Factory set for pickup at 90%. Pickup frequency shall be adjustable from 90 to 100% of nominal. Factory set for pickup at 95%.
 - d. Time Delay for Retransfer to Normal Source: Adjustable from 0 to 30 minutes, and factory set for 10 minutes to automatically defeat delay on loss of voltage or sustained undervoltage of emergency source, provided normal supply has been restored.
 - e. Test Switch: Simulate normal-source failure.
 - f. Switch-Position Indication: Indicate source to which load is connected.
 - g. Source-Available Indication: Supervise sources via transfer switch normal- and emergency-source sensing circuits.
 - h. Normal Power Indication: Indicate "Normal Source Available."
 - i. Emergency Power Indication: Indicate "Emergency Source Available."
 - j. Transfer Override Control: Overrides automatic retransfer control so that automatic transfer switch shall remain connected to emergency power source regardless of condition of normal source. Control panel shall indicate override status.
 - k. Engine Starting Contacts: One isolated and normally closed and one isolated and normally open; rated 5 A at 30 V DC minimum.
 - l. Engine Shutdown Contacts: Time delay adjustable from zero to 15 minutes, and factory set for 5 minutes. Contacts shall initiate shutdown at remote engine-generator controls after retransfer of load to normal source.
 - m. Engine-Generator Exerciser: Programmable exerciser starts engine-generator(s) and transfers load to them from normal source for a preset time, then retransfers and shuts down engine-generator after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from 7 to 30 days. Running periods are adjustable from 10 to 30 minutes. Factory settings shall be for 7-day exercise cycle, 20-minute running period, and 5-minute cool-down period.
14. Controls:

- a. Controls shall provide indication of switch status and be equipped with alarm diagnostics.
 - b. Controls shall control operation of the automatic transfer switches.
15. Factory Wiring: Train and bundle factory wiring and label either by color-code or by numbered/lettered wire markers. Labels shall match those on the shop drawings.
16. Annunciation, Control, and Programming Interface Components: Devices for communicating with remote programming devices, annunciators, or control panel shall have open-protocol communication capability matched with remote device.
17. Motor Disconnect and Timing Relay: Controls designate starters so they disconnect motors before transfer and reconnect them selectively at an adjustable time interval after transfer. Control connection to motor starters is through wiring external to the automatic transfer switch. Time delay for reconnecting individual motor loads is adjustable between 1 and 60 seconds, and settings are as indicated. Relay contacts handling motor-control circuit in-rush and seal currents are rated for actual currents to be encountered.

2.2 SEQUENCE OF OPERATION

- A. The specified voltage decrease in one or more phases of the normal power source shall initiate the transfer sequence. The automatic transfer switch shall start the engine-generator after a specified time delay to permit override of momentary dips in the normal power source.
- B. The automatic transfer switch shall transfer the load from normal to emergency source when the frequency and voltage of the engine-generator has attained the specified percent of rated value.
- C. Engine Start: A voltage decrease, at any automatic transfer switch, in one or more phases of the normal power source to less than the specified value of normal shall start the engine-generator after a specified time delay.
- D. Transfer to Emergency System Loads: Automatic transfer switches for Emergency System loads shall transfer their loads from normal to emergency source when frequency and voltage of the engine-generator have attained the specified percent of rated value. Only those switches with deficient normal source voltage shall transfer.

- E. Transfer to Equipment Branch Loads: Automatic transfer switches for Equipment Branch loads shall transfer their loads to the engine-generator on a time-delayed, staggered basis, after the Emergency System switches have transferred. Only those switches with deficient normal source voltage shall transfer.
- F. Retransfer to Normal (All Loads): Automatic transfer switches shall retransfer the load from emergency to normal source upon restoration of normal supply in all phases to the specified percent or more of normal voltage, and after a specified time delay. Should the emergency source fail during this time, the automatic transfer switches shall immediately transfer to the normal source whenever it becomes available. After restoring to normal source, the engine-generator shall continue to run unloaded for a specified interval before shut-down.

2.3 BYPASS-ISOLATION SWITCH

- A. Provide each automatic transfer switch with two-way bypass-isolation manual type switch. The bypass-isolation switch shall permit load bypass to either normal or emergency power source and complete isolation of the automatic transfer switch, independent of transfer switch position. Bypass and isolation shall be possible under all conditions including when the automatic transfer switch is removed from service.
- B. Operation: The bypass-isolation switch shall have provisions for operation by one person through the movement of a maximum of two handles at a common dead front panel in no more than 15 seconds. Provide a lock, which must energize to unlock the bypass switch, to prevent bypassing to a dead source. Provide means to prevent simultaneous connection between normal and emergency sources.
 - 1. Bypass to normal (or emergency): Operation of bypass handle shall allow direct connection of the load to the normal (or emergency) source, without load interruption or by using a break-before-make design, or provide separate load interrupter contacts to momentarily interrupt the load.
 - a. Ensure continuity of auxiliary circuits necessary for proper operation of the system.
 - b. A red indicating lamp shall light when the automatic transfer switch is bypassed.
 - c. Bypassing source to source: If the power source is lost while in the bypass position, bypass to the alternate source shall be

achievable without re-energization of the automatic transfer switch service and load connections.

2. Isolation: Operation of the isolating handle shall isolate all live power conductors to the automatic transfer switch without interruption of the load.
 - a. Interlocking: Provide interlocking as part of the bypass-isolation switch to eliminate personnel-controlled sequence of operation, and to prevent operation to the isolation position until the bypass function has been completed.
 - b. Padlocking: Include provisions to padlock the isolating handle in the isolated position.
 - c. Visual verification: The isolation blades shall be visible in the isolated position.
3. Testing: It shall be possible to test (normal electrical operation) the automatic transfer switch and engine-generator(s) with the isolation contacts closed and the load bypassed without interruption of power to the load.
- C. Ratings: The electrical capabilities and ratings of the bypass-isolation switch shall be compatible with those of the associated automatic transfer switch, including any required additional withstand tests.

2.4 REMOTE ANNUNCIATOR SYSTEM

- A. Remote annunciator panel shall annunciate conditions for indicated automatic transfer switches. Annunciation shall include the following:
 1. Sources available, as defined by actual pickup and dropout settings of automatic transfer switch controls.
 2. Switch position.
 3. Switch in test mode.
 4. Failure of communication link.
- B. Remote annunciator panel shall be visual and audible type with LED display panel, audible signal, and silencing switch.
 1. Panel shall indicate each automatic transfer switch monitored, the location of automatic transfer switch, and the identity of load it serves.
 2. Mounting: Steel cabinet, flush or surface mounted, as shown on the drawings.

2.5 REMOTE ANNUNCIATOR AND CONTROL SYSTEM

- A. Include the following functions for indicated automatic transfer switches:
 - 1. Indication of sources available, as defined by actual pickup and dropout settings of automatic transfer switch controls.
 - 2. Indication of automatic transfer switch position.
 - 3. Indication of automatic transfer switch in test mode.
 - 4. Indication of failure of communication link.
 - 5. Key-switch or user-code access to control functions of panel.
 - 6. Control of automatic transfer switch test initiation.
 - 7. Control of automatic transfer switch operation in either direction.
 - 8. Control of time-delay bypass for transfer to normal source.
- B. Malfunction of remote annunciator and control system or communication link shall not affect functions of automatic transfer switches. Automatic transfer switch sensing, controlling, or operating functions shall not depend on remote annunciator and control system for proper operation.
- C. Remote annunciation and control system shall include the following features:
 - 1. Touchscreen type operator interface.
 - 2. Control and indication means grouped together for each automatic transfer switch.
 - 3. Label each indication and control group. Indicate the automatic transfer switch it controls, the location of the automatic transfer switch, and the identity of the load that it serves.
 - 4. Digital Communication Capability: Matched to that of automatic transfer switches supervised.
 - 5. Mounting: Steel cabinet, flush or surface mounted, as shown on the drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install automatic transfer switches in accordance with the NEC, as shown on the drawings, and as recommended by the manufacturer.
- B. Anchor automatic transfer switches with rustproof bolts, nuts, and washers not less than 12 mm (1/2 inch) diameter, in accordance with manufacturer's instructions, and as shown on drawings.

C. Mount automatic transfer switches on concrete slab. Unless otherwise indicated, the slab shall be at least 100 mm (4 inches) thick. The top of the concrete slab shall be approximately 100 mm (4 inches) above finished floor. Edges above floor shall have 12.5 mm (1/2 inch) chamfer. The slab shall be of adequate size to project at least 100 mm (8 inches) beyond the equipment. Provide conduit turnups and cable entrance space required by the equipment to be mounted. Seal voids around conduit openings in slab with water- and oil-resistant caulking or sealant. Cut off and bush conduits 75 mm (3 inches) above slab surface. Concrete work shall be as specified in Section 03 30 00, CAST-IN-PLACE CONCRETE.

D. Anchor remote control and/or annunciator panel to wall.

3.2 ACCEPTANCE CHECKS AND TESTS

A. An authorized representative of the automatic transfer switch manufacturer shall technically supervise and participate during all of the field adjustments and tests. Major adjustments and field tests shall be witnessed by the COR. The manufacturer's representative shall certify in writing that the equipment has been installed, adjusted and tested in accordance with the manufacturer's recommendations.

B. Perform manufacturer's required field tests in accordance with the manufacturer's recommendations. In addition, include the following:

1. Visual Inspection and Tests:

- a. Compare equipment nameplate data with specifications and approved shop drawings.
- b. Inspect physical, electrical, and mechanical condition.
- c. Confirm correct application of manufacturer's recommended lubricants.
- d. Verify appropriate anchorage, required area clearances, and correct alignment.
- e. Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method, or performing thermographic survey after energization.
- f. Verify grounding connections.
- g. Verify ratings of sensors.
- h. Vacuum-clean enclosure interior. Clean enclosure exterior.
- i. Exercise all active components.
- j. Verify that manual transfer warning signs are properly placed.

- k. Verify the correct operation of all sensing devices, alarms, and indicating devices.
- 2. Electrical tests:
 - a. Perform insulation-resistance tests.
 - b. After energizing circuits, demonstrate the interlocking sequence and operational function for each automatic transfer switch at least three times.
 - 1) Test bypass-isolation unit functional modes and related automatic transfer switch operations.
 - 2) Power failure of normal source shall be simulated by opening upstream protective device. This test shall be performed a minimum of five times.
 - 3) Power failure of emergency source with normal source available shall be simulated by opening upstream protective device for emergency source. This test shall be performed a minimum of five times.
 - 4) Low phase-to-ground voltage shall be simulated for each phase of normal source.
 - 5) Operation and settings shall be verified for specified automatic transfer switch operational feature, such as override time delay, transfer time delay, return time delay, engine shutdown time delay, exerciser, auxiliary contacts, and supplemental features.
 - 6) Verify pickup and dropout voltages by data readout or inspection of control settings.
 - 7) Verify that bypass and isolation functions perform correctly, including the physical removal of the automatic transfer switch while in bypass mode.
 - c. Ground-fault tests: Verify that operation of automatic transfer switches shall not cause nuisance tripping or alarms of ground fault protection on either source.
 - d. When any defects are detected, correct the defects and repeat the tests as requested by the COR at no additional cost to the Government.

3.3 FIELD SETTINGS VERIFICATION

- A. The automatic transfer switch settings shall be verified in the field by an authorized representative of the manufacturer.

Replace Exterior Lighting on Buildings
VAMC LD, Lexington, KY
Project No. 596-12-101

3.4 FOLLOW-UP VERIFICATION

- A. Upon completion of acceptance checks and tests, the Contractor shall show by demonstration in service that the automatic transfer switches are in good operating condition and properly performing the intended function.

3.5 INSTRUCTION

- A. Furnish the services of a factory-trained technician for one 4-hour training period for instructing personnel in the maintenance and operation of the automatic transfer switches, on the dates requested by the COR.

---END---

SECTION 26 51 00
INTERIOR LIGHTING

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies the furnishing, installation and connection of the interior lighting systems.

1.2 RELATED WORK

- A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General requirements that are common to more than one section of Division 26.
- B. Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Cables and wiring.
- C. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path to ground for possible ground fault currents.

1.3 QUALITY ASSURANCE

Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

- A. In accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, submit the following:
- B. Product Data: For each type of lighting fixture (luminaire) designated on the LIGHTING FIXTURE SCHEDULE, arranged in order of fixture designation, submit the following information.
 - 1. Material and construction details include information on housing, optics system and lens/diffuser.
 - 2. Physical dimensions and description.
 - 3. Wiring schematic and connection diagram.
 - 4. Installation details.
 - 5. Energy efficiency data.
 - 6. Photometric data based on laboratory tests complying with IESNA Lighting Measurements, testing and calculation guides.
 - 7. Lamp data including lumen output (initial and mean), color rendition index (CRI), rated life (hours) and color temperature (degrees Kelvin).
 - 8. Ballast data including ballast type, starting method, ambient temperature, ballast factor, sound rating, system watts and total harmonic distortion (THD).
- C. Manuals:

1. Submit, simultaneously with the shop drawings companion copies of complete maintenance and operating manuals including technical data sheets, and information for ordering replacement parts.
2. Two weeks prior to the final inspection, submit four copies of the final updated maintenance and operating manuals, including any changes, to the COTR.

D. Certifications:

1. Two weeks prior to final inspection, submit four copies of the following certifications to the COTR:
 - a. Certification by the Contractor that the equipment has been properly installed, adjusted, and tested.

1.5 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.
- B. Institute of Electrical and Electronic Engineers (IEEE):
- C62.41-91.....Guide on the Surge Environment in Low Voltage
(1000V and less) AC Power Circuits
- C. National Fire Protection Association (NFPA):
- 70.....National Electrical Code (NEC)
101.....Life Safety Code
- D. National Electrical Manufacturer's Association (NEMA):
- C82.1-97.....Ballasts for Fluorescent Lamps - Specifications
C82.2-02.....Method of Measurement of Fluorescent Lamp
Ballasts
C82.4-02.....Ballasts for High-Intensity-Discharge and Low-
Pressure Sodium Lamps
C82.11-02.....High Frequency Fluorescent Lamp Ballasts
- E. Underwriters Laboratories, Inc. (UL):
- 542-99.....Lampholders, Starters, and Starter Holders for
Fluorescent Lamps
844-95.....Electric Lighting Fixtures for Use in Hazardous
(Classified) Locations
924-95.....Emergency Lighting and Power Equipment
935-01.....Fluorescent-Lamp Ballasts
1029-94.....High-Intensity-Discharge Lamp Ballasts
1029A-06.....Ignitors and Related Auxiliaries for HID Lamp
Ballasts
1598-00.....Luminaires

8750-08.....Light Emitting Diode (LED) Light Sources for Use
in Lighting Products

F. Federal Communications Commission (FCC):

Code of Federal Regulations (CFR), Title 47, Part 18

PART 2 - PRODUCTS

2.1 LIGHTING FIXTURES (LUMINAIRES)

A. Shall be in accordance with NFPA 70 and UL 1598, as shown on drawings, and as specified.

B. Sheet Metal:

1. Shall be formed to prevent warping and sagging. Housing, trim and lens frame shall be true, straight (unless intentionally curved) and parallel to each other as designed.

2. Wireways and fittings shall be free of burrs and sharp edges and shall accommodate internal and branch circuit wiring without damage to the wiring.

3. When installed, any exposed fixture housing surface, trim frame, door frame and lens frame shall be free of light leaks; lens doors shall close in a light tight manner.

4. Hinged door closure frames shall operate smoothly without binding when the fixture is in the installed position, latches shall function easily by finger action without the use of tools.

C. Ballasts shall be serviceable while the fixture is in its normally installed position, and shall not be mounted to removable reflectors or wireway covers unless so specified.

D. Lamp Sockets:

1. Fluorescent: Lampholder contacts shall be the biting edge type or phosphorous-bronze with silver flash contact surface type and shall conform to the applicable requirements of UL 542. Lamp holders for bi-pin lamps shall be of the telescoping compression type, or of the single slot entry type requiring a one-quarter turn of the lamp after insertion.

2. High Intensity Discharge (H.I.D.): Shall have porcelain enclosures.

E. Recessed fixtures mounted in an insulated ceiling shall be listed for use in insulated ceilings.

F. Mechanical Safety: Lighting fixture closures (lens doors, trim frame, hinged housings, etc.) shall be retained in a secure manner by captive screws, chains, captive hinges or fasteners such that they cannot be accidentally dislodged during normal operation or routine maintenance.

G. Metal Finishes:

1. The manufacturer shall apply standard finish (unless otherwise specified) over a corrosion resistant primer, after cleaning to free the metal surfaces of rust, grease, dirt and other deposits. Edges of pre-finished sheet metal exposed during forming, stamping or shearing processes shall be finished in a similar corrosion resistant manner to match the adjacent surface(s). Fixture finish shall be free of stains or evidence of rusting, blistering, or flaking, and shall be applied after fabrication.
2. Interior light reflecting finishes shall be white with not less than 85 percent reflectances, except where otherwise shown on the drawing.
3. Exterior finishes shall be as shown on the drawings.
- H. Lighting fixtures shall have a specific means for grounding metallic wireways and housings to an equipment grounding conductor.
- I. Light Transmitting Components for Fluorescent Fixtures:
 1. Shall be 100 percent virgin acrylic.
 2. Flat lens panels shall have not less than 1/8 inch [3.2mm] of average thickness. The average thickness shall be determined by adding the maximum thickness to the minimum unpenetrated thickness and dividing the sum by 2.
 3. Unless otherwise specified, lenses, diffusers and louvers shall be retained firmly in a metal frame by clips or clamping ring in such a manner as to allow expansion and contraction of the lens without distortion or cracking.
- J. Compact fluorescent fixtures shall be manufactured specifically for compact fluorescent lamps with ballast integral to the fixture. Assemblies designed to retrofit incandescent fixtures are prohibited except when specifically indicated for renovation of existing fixtures (not the lamp). Fixtures shall be designed for lamps as specified.

2.2 BALLASTS

- A. Compact Fluorescent Lamp Ballasts: Multi-voltage (120 - 277V), electronic-programmed rapid-start type, complying with UL 935 and with ANSI C 82.11, designed for type and quantity of lamps indicated. Ballast shall be designed for full light output unless dimmer or bi-level control is indicated; including the following features:
 1. Lamp end-of-life detection and shutdown circuit.
 2. Automatic lamp starting after lamp replacement.
 3. Sound Rating: Class A.
 4. Total Harmonic Distortion Rating: 10 percent or less.
 5. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.

6. Operating Frequency: 20 kHz or higher.
 7. Lamp Current Crest Factor: 1.7 or less.
 8. Ballast Factor: 0.95 or higher unless otherwise indicated.
 9. Power Factor: 0.98 or higher.
 10. Interference: Comply with 47 CFR 18, Ch. 1, Subpart C, for limitations on electromagnetic and radio-frequency interference for non-consumer equipment.
- B. Ballasts for high intensity discharge fixtures: Multi-tap voltage (120-480v) electromagnetic ballast for high intensity discharge lamps. Comply with ANSI C82.4 and UL 1029. Include the following features unless otherwise indicated:
1. Ballast Circuit: Constant-wattage autotransformer or regulating high-power-factor type.
 2. Minimum Starting Temperature: Minus 22 deg F (Minus 30 deg C) for single-lamp ballasts.
 3. Rated Ambient Operating Temperature: 104deg F (40 deg C).
 4. Open-circuit operation that will not reduce average life.
5. Low-Noise Ballasts: Manufacturers' standard epoxy-encapsulated models designed to minimize audible fixture noise.

2.3 FLUORESCENT EMERGENCY BALLAST

- A. Self-contained, modular, battery-inverter unit, factory mounted within lighting fixture body and compatible with ballast. Comply with UL 924.
1. Emergency Connection: Operate two fluorescent lamp(s) continuously at an output of 1100 lumens each. Connect unswitched circuit to battery-inverter unit and switched circuit to fixture ballast.
 2. Test Push Button and Indicator Light: Visible and accessible without opening fixture or entering ceiling space.
 - a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 3. Battery: Sealed, maintenance-free, nickel-cadmium type.
 4. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
 5. Integral Self-Test: Automatically initiates test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing LED.

2.4 LAMPS

- A. Compact Fluorescent Lamps:

1. T4, CRI 80 (minimum), color temperature 3500 K, and suitable for use with dimming ballasts, unless otherwise indicated.
- B. Long Twin-Tube Fluorescent Lamps:
 1. T5, CRI 80 (minimum), color temperature between 3500° and 4100°K, 20,000 hours average rated life.
- C. High Intensity Discharge Lamps:
 1. High-Pressure Sodium Lamps: ANSI C78.42, CRI 21 (minimum), color temperature 1900°K, and average rated life of 24,000 hours, minimum.

2.5 EXIT LIGHT FIXTURES

- A. Exit light fixtures shall meet applicable requirements of NFPA 101 and UL 924.
- B. Housing and Canopy:
 1. Shall be made of die-cast aluminum.
 2. Optional steel housing shall be a minimum 20 gauge thick or equivalent strength aluminum.
 3. Steel housing shall have baked enamel over corrosion resistant, matte black or ivory white primer.
- C. Door frame shall be cast or extruded aluminum, and hinged with latch.
- D. Finish shall be satin or fine-grain brushed aluminum.
- E. There shall be no radioactive material used in the fixtures.
- F. Fixtures:
 1. Maximum fixture wattage shall be 1 watt or less.
 2. Inscription panels shall be cast or stamped aluminum a minimum of 0.090 inch [2.25mm] thick, stenciled with 6 inch [150mm] high letters, baked with red color stable plastic or fiberglass. Lamps shall be luminous Light Emitting Diodes (LED) mounted in center of letters on red color stable plastic or fiberglass. The LED shall be rated minimum 25 years life.
 3. Double-Faced Fixtures: Provide double-faced fixtures where required or as shown on drawings.
 4. Directional Arrows: Provide directional arrows as part of the inscription panel where required or as shown on drawings. Directional arrows shall be the "chevron-type" of similar size and width as the letters and meet the requirements of NFPA 101.
- G. Voltages: Refer to Lighting Fixture Schedule.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation shall be in accordance with the NEC, manufacturer's instructions and as shown on the drawings or specified.
- B. Align, mount and level the lighting fixtures uniformly.

- C. Fluorescent bed light fixtures shall be attached to the studs in the walls. Attachment to gypsum board only is not acceptable.
- D. Lighting Fixture Supports:
 - 1. Shall provide support for all of the fixtures. Supports may be anchored to channels of the ceiling construction, to the structural slab or to structural members within a partition, or above a suspended ceiling.
 - 2. Shall maintain the fixture positions after cleaning and relamping.
 - 3. Shall support the lighting fixtures without causing the ceiling or partition to deflect.
 - 4. Hardware for surface mounting fluorescent fixtures to suspended ceilings:
 - a. In addition to being secured to any required outlet box, fixtures shall be bolted to a grid ceiling system at four points spaced near the corners of each fixture. The bolts shall be not less than 1/4 inch [6mm] secured to channel members attached to and spanning the tops of the ceiling structural grid members. Non-turning studs may be attached to the ceiling structural grid members or spanning channels by special clips designed for the purpose, provided they lock into place and require simple tools for removal.
 - b. In addition to being secured to any required outlet box, fixtures shall be bolted to ceiling structural members at four points spaced near the corners of each fixture. Pre-positioned 1/4 inch [6mm] studs or threaded plaster inserts secured to ceiling structural members shall be used to bolt the fixtures to the ceiling. In lieu of the above, 1/4 inch [6mm] toggle bolts may be used on new or existing ceiling provided the plaster and lath can safely support the fixtures without sagging or cracking
 - 5. Surface mounted lighting fixtures:
 - a. Fixtures shall be bolted against the ceiling independent of the outlet box at four points spaced near the corners of each unit. The bolts (or stud-clips) shall be minimum 1/4-20 [6mm] bolt, secured to main ceiling runners and/or secured to cross runners. Non-turning studs may be attached to the main ceiling runners and cross runners with special non-friction clip devices designed for the purpose, provided they bolt through the runner, or are also secured to the building structure by 12 gauge safety hangers. Studs or bolts securing fixtures weighing in excess of 56 pounds [25kg] shall be supported directly from the building structure.

- b. Where ceiling cross runners are installed for support of lighting fixtures they must have a carrying capacity equal to that of the main ceiling runners and be rigidly secured to the main runners.
- c. Fixtures less than 15 pounds [6.8kg] in weight and occupying less than two square feet [600mm x 600mm] of ceiling area may, (when designed for the purpose) be supported directly from the outlet box when all the following conditions are met.
 - 1) Screws attaching the fixture to the outlet box pass through round holes (not key-hole slots) in the fixture body.
 - 2) The outlet box is attached to a main ceiling runner (or cross runner) with approved hardware.
 - 3) The outlet box is supported vertically from the building structure.
- d. Fixtures mounted in open construction shall be secured directly to the building structure with approved bolting and clamping devices.
- 6. Outlet boxes for support of lighting fixtures (where permitted) shall be secured directly to the building structure with approved devices or supported vertically in a hung ceiling from the building structure with a nine gauge wire hanger, and be secured by an approved device to a main ceiling runner or cross runner to prevent any horizontal movement relative to the ceiling.
- E. Furnish and install the specified lamps for all lighting fixtures installed and all existing lighting fixtures reinstalled under this project.
- F. Coordinate between the electrical and ceiling trades to ascertain that approved lighting fixtures are furnished in the proper sizes and installed with the proper devices (hangers, clips, trim frames, flanges), to match the ceiling system being installed.
- G. Bond lighting fixtures and metal accessories to the grounding system as specified in Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.
- H. Exercise electronic dimming ballasts over full range of dimming capability by operating the control device(s) in the presence of the COTR. Observe for visually detectable flicker over full dimming range.
- I. Burn-in all lamps that require specific aging period to operate properly, prior to occupancy by Government. Burn-in period to be 40 hours minimum, unless a lesser period is specifically recommended by lamp manufacturer. Burn-in fluorescent and compact fluorescent lamps intended to be dimmed, for at least 100 hours at full voltage. Replace any lamps and ballasts which fail during burn-in.

Replace Exterior Lighting on Buildings
VAMC LD, Lexington, KY
Project No. 596-12-101

J. At completion of project, relamp/reballast fixtures which have failed lamps/ballasts. Clean fixtures, lenses, diffusers and louvers that have accumulated dust/dirt/fingerprints during construction. Replace damaged lenses, diffusers and louvers with new.

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SECTION 26 56 00
EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies the furnishing, installation, and connection of exterior luminaires, poles, and supports.

1.2 RELATED WORK

- A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that are common to more than one section of Division 26.
- B. Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Low voltage power and lighting wiring.
- C. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.
- D. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits, fittings, and boxes for raceway systems.

1.3 QUALITY ASSURANCE

Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

- A. Submit in accordance with Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
- B. Shop Drawings:
 - 1. Clearly present sufficient information to determine compliance with drawings and specifications.
 - 2. Include electrical ratings, dimensions, mounting, details, materials, required clearances, terminations, wiring and connection diagrams, photometric data, ballasts, luminaires, lamps, and accessories.
- C. Manuals: Two weeks prior to final inspection, submit four copies of operating and maintenance manuals to the COTR. Include technical data sheets, wiring and connection diagrams, and information for ordering replacement lamps, ballasts, and parts.

D. Certifications: Two weeks prior to final inspection, submit four copies of the following to the COTR:

1. Certification by the manufacturer that the materials are in accordance with the drawings and specifications.
2. Certification by the contractor that the complete installation has been properly installed and tested.

1.5 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.

B. Aluminum Association Inc. (AA):

AAH35.1-06.....Alloy and Temper Designation Systems for
Aluminum

C. American Association of State Highway and Transportation Officials
(AASHTO):

LTS-5-09Structural Supports for Highway Signs,
Luminaires and Traffic Signals

D. American National Standards Institute (ANSI):

C81.61-09Electrical Lamp Bases - Specifications for
Bases (Caps) for Electric Lamps

E. American Society for Testing and Materials (ASTM):

A123/A123M-09Zinc (Hot-Dip Galvanized) Coatings on Iron and
Steel Products

A153/A153M-09.....Zinc Coating (Hot-Dip) on Iron and Steel
Hardware

B108-03a-08Aluminum-Alloy Permanent Mold Castings

C1089-06Spun Cast Prestressed Concrete Poles

F. Illuminating Engineering Society of North America (IESNA)

HB-9-00.....Lighting Handbook

RP-33-99.....Lighting for Exterior Environments

LM-5-96.....Photometric Measurements of Area and Sports
Lighting Installations

LM-72-97.....Directional Positioning of Photometric Data

LM-79-08.....Approved Method for the Electrical and
Photometric Measurements of Solid-State Lighting
Products

LM-80-08.....Approved Method for Measuring Lumen Maintenance
of LED Light Sources

I. National Electrical Manufacturers Association (NEMA):

C78.41-06.....Electric Lamps - Guidelines for Low-Pressure
Sodium Lamps

C78.42-07Electric Lamps - Guidelines for High-Pressure
Sodium Lamps

C82.4-02Ballasts for High-Intensity-Discharge and Low-
Pressure Sodium Lamps (Multiple-Supply Type)

ICS 6-93 (R2006)Enclosures

J. National Fire Protection Association (NFPA):

70-08National Electrical Code (NEC)

K. Underwriters Laboratories, Inc. (UL):

496-08Lampholders

773-95.....Plug-In, Locking Type Photocontrols for Use
with Area Lighting

773A-06Nonindustrial Photoelectric Switches for
Lighting Control

1029-94.....High-Intensity-Discharge Lamp Ballasts

1598-08Luminaires

8750-08.....Light Emitting Diode (LED) Light Sources for
Use in Lighting Products

1.6 DELIVERY, STORAGE, AND HANDLING

Provide manufacturer's standard provisions for protecting pole finishes during transport, storage, and installation. Do not store poles on ground. Store poles so they are at least 12 in [305 mm] above ground level and growing vegetation. Do not remove factory-applied pole wrappings until just before installing pole.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

Materials and equipment shall be in accordance with NEC, UL, ANSI, and as shown on the drawings and specified.

2.2 LUMINAIRES

- A. Per UL 1598 and NEMA C136.17. Luminaires shall be weatherproof, heavy duty, outdoor types designed for efficient light utilization, adequate dissipation of lamp and ballast heat, and safe cleaning and relamping.
- B. Light distribution pattern types shall be as shown on the drawings.

- C. Incorporate ballasts in the luminaire housing, except where otherwise shown on the drawings.
- D. Lenses shall be frame-mounted, heat-resistant, borosilicate glass, with prismatic refractors, unless otherwise shown on the drawings. Attach the frame to the luminaire housing by hinges or chain. Use heat and aging-resistant, resilient gaskets to seal and cushion lenses and refractors in luminaire doors.
- E. Lamp sockets for high intensity discharge (H.I.D) fixture shall have locking-type porcelain enclosures in conformance to the applicable requirements of ANSI C81.61 and UL 496.
- F. Pre-wire internal components to terminal strips at the factory.
- G. Bracket-mounted luminaires shall have leveling provisions and clamp-type adjustable slip-fitters with locking screws.
- H. Materials shall be rustproof. Latches and fittings shall be non-ferrous metal.
- I. Provide manufacturer's standard finish, as scheduled on the drawings. Where indicated on drawings, match finish process and color of pole or support materials.
- J. Luminaires shall carry factory labels, showing complete, specific lamp and ballast information.

2.5 LAMPS

- A. Install the proper lamps in every luminaire installed.
- B. Lamps shall be general-service, outdoor lighting types.
- C. High-Pressure Sodium (HPS) Lamps: NEMA C78.42, CRI 21 (minimum), wattage as indicated. Lamps shall have minimum average rated life of 24,000 hours.
- D. Low-Pressure Sodium (LPS) Lamps: NEMA C78.43.
- E. LED sources shall meet the following requirements:
 - 1. Operating temperature rating shall be between -40° F [-40° C] and 120° F [50° C].
 - 2. Correlated Color Temperature (CCT): 2700K.
 - 3. Color Rendering Index (CRI): ≥ 65.
 - 4. The manufacturer shall have performed JEDEC (Joint Electron Devices Engineering Council) reliability tests on the LEDs as follows: High Temperature Operating Life (HTOL), Room Temperature Operating Life (RTOL), Low Temperature Operating Life (LTOL), Powered Temperature

Cycle (PTMCL), Non-Operating Thermal Shock (TMSK), Mechanical Shock
Variable Vibration Frequency, and Solder Heat Resistance (SHR).

G. Mercury vapor lamps shall not be used.

2.6 HIGH INTENSITY DISCHARGE BALLASTS

- A. Per NEMA C82.4 and UL 1029. Ballasts shall be single-lamp, copper-wound, constant-wattage autotransformer type, designed to operate on the voltage system to which they are connected, and capable of open-circuit operation without reducing lamp life.
- B. Ballasts shall have individual overcurrent protection in each ungrounded supply conductor.
- C. Ballast shall have an allowable line voltage variations of $\pm 10\%$, with a maximum 20% lamp wattage regulation spread.
- D. Power factor shall be not less than 90%.
- E. Ballast shall have a minimum starting temperature of $-22^{\circ}\text{ F } [-30^{\circ}\text{ C}]$, and a normal ambient operating temperature of $104^{\circ}\text{ F } [40^{\circ}\text{ C}]$.
- F. Lamp current crest factor shall be 1.8 or less, in accordance with lamp manufacturer recommendations.

2.7 LED DRIVERS

- A. LED drivers shall meet the following requirements:
 - 1. Drivers shall have a minimum efficiency of 85%.
 - 2. Starting Temperature: $-40^{\circ}\text{ F } [-40^{\circ}\text{ C}]$.
 - 3. Input Voltage: 120 to 480 ($\pm 10\%$) V.
 - 4. Power Supplies: Class I or II output.
 - 5. Surge Protection: The system must survive 250 repetitive strikes of "C Low" (C Low: $6\text{ kV}/1.2 \times 50 \mu\text{s}$, $10\text{ kA}/8 \times 20 \mu\text{s}$) waveforms at 1-minute intervals with less than 10% degradation in clamping voltage. "C Low" waveforms are as defined in IEEE/ASNI C62.41.2-2002, Scenario 1 Location Category C.
 - 6. Power Factor (PF): ≥ 0.90 .
 - 7. Total Harmonic Distortion (THD): $\leq 20\%$.
 - 8. Comply with FCC Title 47 CFR Part 18 Non-consumer RFI/EMI Standards.
 - 9. Drivers shall be reduction of hazardous substances (ROHS)-compliant.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install lighting in accordance with the NEC, as shown on the drawings, and in accordance with manufacturer's recommendations.
- B. Install lamps in each luminaire.

Replace Exterior Lighting on Buildings
VAMC LD, Lexington, KY
Project No. 596-12-101

C. Adjust luminaires that require field adjustment or aiming.

3.2 GROUNDING

Ground noncurrent-carrying parts of equipment, including metal poles, luminaires, mounting arms, brackets, and metallic enclosures, as specified in Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS. Where copper grounding conductor is connected to a metal other than copper, provide specially-treated or lined connectors suitable and listed for this purpose.

3.3 ACCEPTANCE CHECKS AND TESTS

Verify operation after installing luminaires and energizing circuits.

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